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BELL (A. F.).—**Entomology.**—*Rep. Bur. Sug. Exp. Stas. Qd* **35** pp. 48–53. Brisbane, 1935.

Owing to the abnormally hot and dry weather in Queensland in the latter part of 1934 and the early months of 1935, injury by insect pests of sugar-cane was very much reduced. Practically no noticeable damage was caused by the larvae of *Lepidoderma albohirtum*, Waterh., which had been very injurious in the previous season [*R.A.E.*, A **23** 265]. Most of the beetles that emerged in November were killed, whilst those that were still in their pupal cells in the soil were unable to emerge. By 25th January, 70 per cent. of the latter were dead and the rest were too weak to oviposit when rain fell in late January and were killed by a further period of dry weather. In a few localities where thunderstorms had occurred in September and October, the beetles had developed normally and laid eggs before the advent of the hot weather, but the resulting larvae were killed by fumigation. Many of the larvae and eggs were destroyed through desiccation, owing to the excessively high soil temperatures (100°F. and 99·5°F. at depths of 4 and 8 ins. respectively). In experiments with fumigants, a mixture of 2 parts carbon bisulphide and 1 part paradichlorobenzene gave the best control, whilst carbon bisulphide alone was nearly as efficient. The soil was so dry that the larvae, instead of moving downwards, were forced to migrate to the cane roots to obtain sufficient moisture. By fumigating at this time, when the liquids volatilised more rapidly, a high degree of mortality was obtained. The optimum dosage of carbon bisulphide for fumigating the soil was between 4·5 and 5 ml. [about 0·17 fl. oz.] applied at intervals of 15 ins. With the trap previously described [**23** 266] 100,000 beetles were caught in 20 nights from 3 *Ficus* trees 50 yds. apart. The numbers of males and females were about equal. From the small number of gravid females obtained, it appeared that the beetle population was diminishing. It was recommended that lightly infested canefields should be fumigated in order to reduce still further the depleted grub population and prevent any considerable emergence of beetles in 1936.

Rhabdocnemis obscura, Boisd., was also much less injurious in 1935. The Tachinid parasite, *Ceromasia sphenophori*, Villen., was recovered easily even where only moderate borer damage occurred, though the percentage parasitism was only 1–2. During September and October 1935 the percentage parasitism was much higher, but unless a high degree of parasitism is maintained for some months before the crushing season and prevents further damage by destroying the developing borers, its effect is practically negligible. Although the weather was not favourable for the establishment of large populations of the larvae of *Lacon variabilis*, Cand. [*cf.* **23** 202], plants in several badly-drained hollows and ends of fields were considerably injured. In some of the heavy blacksoil fields, *Crepidomenus queenslandicus*, Blr., caused some damage.

Investigations were carried out by [W. A.] McDougall on *Phragmatiphila truncata*, Wlk. In the laboratory between July and September females laid up to 1,200 fertile eggs each, which is probably the maximum. Oviposition usually began on the third night after emergence and occasionally continued for the four succeeding nights. Both in the laboratory and in field cages, the egg stage occupied 10–12 days at 62·3°F. The pupal stage varied from 20 to 26 days. The eggs are

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deposited beneath the edges of the outer fresh and tightly rolled leaf-sheaths of cane-shoots or of grasses, and are therefore difficult to find. The third and fourth instar larvae cause dead-hearts, but smaller ones are seldom found in damaged cane. In the laboratory the younger larvae burrow in the tissue of individual leaf-sheaths instead of through fresh tissue to the centre of the shoots. In addition to *Apanteles flavipes*, Cam., an Ichneumonid was bred from a full-grown larva, and another parasitised 7 out of 322 pupae. From September onwards, young ratoon cane in the north was damaged by army worms, mainly *Cirphis loreyi*, Dup. Rains in October helped the cane to outgrow the damage and extensive parasitism also occurred. An Ichneumonid and 3 species of Tachinids were bred from larvae in the laboratory.

During the year, 102 individuals of the toad, *Bufo marinus*, were introduced from Hawaii, primarily for the control of *L. albohirtum*, and liberated in a specially constructed pond at Meringa. One female laid eggs and from these 4,500 young toads hatched and were liberated, together with a few of the original toads, in infested areas. They appear to be breeding readily.

KISHIDA (K.). **Notes on the Acarina and Ticks from the Island of Formosa, collected in August 1935.**—*Lansania* **7** no. 69 pp. 129–144, 1 fig. Tokyo, October 1935.

The mites recorded include *Rhizoglyphus echinopus* F. & R., on a lily bulb; *Bryobia* sp. on rose; *Tetranychus* sp. on mint (*Mentha*), and *Tarsonemus* sp. on pineapple.

YANAGIHARA (M.). **Notes on the Habits and Control of *Alissonotum* Beetles injurious to Sugar-cane in Formosa.** [*In Japanese.*]—*Rep. Govt Sug. Exp. Sta. Formosa* no. 2, pp. 111–136, 7 figs. Formosa, October 1935. (With a Summary in English.)

Alissonotum impressicolle, Arrow, *A. crassum*, Arrow, and *A. pauper*, Burm., cause serious damage to sugar-cane in southern Formosa. Both adults and larvae feed on the subterranean parts of the cane, the adults being most injurious in May and June. *Imperata* and *Miscanthus* also serve as food-plants, but sugar-cane is preferred. Keys are given to the adults and larvae of these Dynastids, and the eggs and pupae are briefly described.

The adults emerge from late March to May, and live about 6 months. They appear above ground and are active after heavy rain, when they migrate to new fields, but remain underground if it is dry. Oviposition takes place from mid-September to late October, a female laying an average of 50 eggs singly. The larvae hatch in about a fortnight, have three instars, and mature in about 22 weeks, and the pupal stage lasts about 17 days. The young larvae feed first on vegetable matter in the soil and then on the sugar-cane roots, and the third instar larvae bore into the subterranean parts of the stems from January to March, causing serious damage to the mature cane in February. It is therefore advisable to harvest the crop early. Collecting the beetles and larvae after flooding or ploughing, and fallowing, crop rotation, and irrigation from March to April are also recommended. Paradichlorobenzene is an effective soil fumigant, but is too expensive to use in Formosa. A Scoliid of the genus *Tiphia* is parasitic on the larvae, but does not control them. The toad, *Bufo melanosticus*, feeds on the

adults when they appear above ground from May to September, and a bird (*Buchanga atra cathoeca*) destroys the adults and larvae when the fields are ploughed.

KOIDSUMI (K.) & SHIBATA (K.). **Notes on the Autecology of some Fruit-flies. II. On the Mango-fly,** *Chaetodacus ferrugineus* **var.** *dorsalis* **Hendel.** [*In Japanese.*]—*J. Soc. trop. Agric.* **7** no. 4 pp. 370–378. Taihoku, December 1935.

Dacus (*Chaetodacus*) *dorsalis*, Hend., is a very serious pest in Formosa, where it has several generations a year and infests a wide range of fruits. The adults are more active than those of *D. cucurbitae*, Coq., and a larger space is required for breeding them. They emerge before noon, and are most active at 25–30°C. [77–86°F.], becoming dormant below 20°C. [68°F.]. They lived about a week when given water only, and over a month when fed on honey, but did not oviposit. They lived much longer and laid eggs when fed on banana or other fruits. Oviposition began 20 days after emergence in summer, 25–60 days in autumn, and 100 in winter, when the flies were fed on orange juice. Females that were about to oviposit drove away others from the fruits. They lay fewer eggs in a fruit than *D. cucurbitae*, only 20–30 larvae being usually found even in a large one, as compared with 200–300 of the latter species. A single egg hole generally contains 5–10 eggs. The number of eggs laid by one female is usually about 500 and sometimes 1,000. Even *Citrus* fruits that are strongly acid (pH 2·2–2·7) are sometimes attacked, and the larvae mature in them. Flies in captivity laid eggs in ripened papaya, bruised pineapple, banana, pear, apple and persimmon, and the larvae matured in all except the last two, though they are not usually attacked in the field. Apple is not grown in Formosa. Captive flies also laid eggs in lemon, but the eggs or newly hatched larvae died. In the northern part of Formosa, the flies are dormant in winter though they emerge from the pupae, and the eggs and larvae do not develop.

TOKUNAGA (M.) & KURODA (M.). **Unrecorded Chironomid Flies from Japan (Diptera) with a Description of a new Species.**—*Trans. Kansai Ent. Soc.* no. 6 pp. 1–8, 1 pl., 3 figs. Osaka, November 1935.

Chironomus (*Stenochironomus*) *nelumbus*, sp. n., is described from Kyoto, where the larvae injure the floating leaves of *Nelumbo nucifera*, the root of which is used as food. They have not been found to attack other related aquatic plants. They hatch from egg cords at the water's edge and mine in the leaves. The pupal stage is passed in the mine, and lasted 3 days in autumn. The adults emerged at night, and both sexes lived for an average of 2½ days. Exposed larvae died in 45 minutes at 27°C. [80·6°F.] and a relative humidity of 75 per cent., and larvae in leaves removed from the water died within 10 hours at 26°C. [78·8°F.] and 82 per cent. humidity. Drainage, therefore, seems likely to be effective for control.

KANDA (S.). **Notes on** *Antonina tobai* **Kuw.** [*In Japanese.*]—*Insect World* **40** no. 1 pp. 5–7. Gifu, January 1936.

The author considers that *Serrolecanium bambusae*, Shinji, is a synonym of *Antonina tobai*, Kuw., which belongs to the subfamily DACTYLOPIINAE [*cf. R.A.E.*, A **23** 514].

INAFU (S.). **On** *Oxya*. [*In Japanese.*]—*Insect World* **40** no. 1 pp. 9–16. Gifu, January 1936.

Experiments showed that the vitamin content of grasshoppers of the genus *Oxya* renders them of value as food for fowls.

HIROSE (K.). **On** *Dichocrocis chloraphanta* **Butl., a new Pest of Persimmon.** [*In Japanese.*]—*Insect World* **40** no. 1 pp. 18–20. Gifu, January 1936.

The Pyralid, *Dichocrocis chloraphanta*, Butl., is rather common on persimmon [*Diospyros kaki*] near Gifu, and has 2 or 3 generations a year, but is not a serious pest. The larvae roll the leaves and hibernate in cocoons. The pupal stage lasts 8–10 days in summer.

KOBAYASHI (G.). *Parlatoria pergandei* **Comst.** [*In Japanese.*]—*Insect World* **40** no. 1 pp. 7–9. Gifu, January 1936.

In Wakayama Prefecture (Honshu), *Parlatoria pergandei*, Comst., overwinters in the adult stage and has 3 generations a year, the larvae swarming in March–May, June–July, and September–October. The female lays about 50 eggs. The food-plants include *Citrus*, tea, plum, rose and *Magnolia*. The control measures recommended are fumigation with hydrocyanic acid gas, and spraying with oil emulsion in winter, lime-sulphur in March before the buds unfold, or resin and sodium hydroxide [see next paper] in summer.

KOBAYASHI (G.). **Control Methods for** *Pulvinaria aurantii* **Ckll.** [*In Japanese.*]—*Insect World* **40** no. 2 pp. 47–49. Toyko, February 1936.

In Wakayama Prefecture *Pulvinaria aurantii*, Ckll., is common on *Citrus* and has 2 generations a year, passing the winter in the larval stage. The first oviposition takes place in May, when one female produces about 400 eggs, which hatch in about 20 days. A female of the summer brood produces about 250 eggs, which hatch in September. The Coccinellid, *Chilocorus rubidus*, Hope, is an effective predator. Fumigation with hydrocyanic acid gas in January or February and in summer is effective for control, and a resin wash applied in late June and September is also recommended. The formula is $3\frac{3}{4}$ lb. resin, $2\frac{1}{4}$ lb. sodium hydroxide and 1·8 gals. water, diluted for use at the rate of 1 : 30.

KABURAKI (T.). **On the Positive Phototropism of** *Chilo simplex* **Butl.** [*In Japanese.*]—*Bot. & Zool.* **4** no. 2 pp. 161–166. Tokyo, February 1936.

Of females of *Chilo simplex*, Butl. (rice moth borer) taken in light-traps in Japan, 50–90 per cent. had not finished oviposition and about 26 per cent. had laid no eggs.

DELASSUS (—) & LAFFOND (—). **L'utilisation des poudres à base de rotenone dans la lutte contre l'eudémis.**—*C. R. Acad. Agric. Fr.* **22** no. 3 pp. 94–98. Paris, 1936.

Experiments were carried out in Algeria in 1935 with dusts containing rotenone against *Polychrosis botrana*, Schiff., on grapes, since

arsenical sprays, which are effective, and even barium fluosilicate dusts, which have been used with some success, cannot be continued up to the harvest because they leave dangerous residues.

No treatment was applied against the first generation larvae. Against the second generation, a dust containing rotenone was applied on 20th June to all vines. Against the third generation three dusts were applied twice, on 2nd and 9th August, each to 3 rows of 80 vines at the rate of about 18 lb. for the 3 rows. The moths had been seen in flight on 4th August. Treatment with dusts containing 1·5 and 3·0 per cent. rotenone and similar substances (deguelin, tephrosin, etc.) gave about 40 per cent. uninjured grapes and with a coarser dust containing 2·0 per cent. rotenone, etc., about 23 per cent., whilst the controls were almost completely ruined.

Division of Entomology.—*Rep. N. Y. St. agric. Exp. Sta.* **54** (1934–35) pp. 51–61. Geneva, N.Y., 1936.

Much of the work here recorded against insect pests in New York State, chiefly in 1934, has already been noticed [*R.A.E.*, A **23** 315, 366, 386, 459, 460, 509, 528, 645]. Infestation of apple by the codling moth [*Cydia pomonella*, L.] was severe in the north-east, moderate in the west and light but increasing in the north. Lead arsenate gave the best results, and combined with summer oil it was efficient when eggs were most numerous [*cf.* **23** 317, 322]. When cover sprays contained 3 lb. lead arsenate in 100 U.S. gals. spray, washing with 1 per cent. hydrochloric acid removed the residues; but when they contained more lead arsenate it was necessary to use 1½ per cent. acid. If oil had been used in the combination, the bath was warmed to 85°F. Owing to the increased injury to pears by *C. pomonella*, spraying with lead arsenate has become necessary, but the size, shape and tenderness of the fruit make the removal of residues by washing more difficult.

Only 7 per cent. of the peach crop was injured by *C. molesta*, Busck, in 1934. The crop was half the size of that in 1933 [*cf.* **23** 237], but the percentage infested was about the same. In western New York, *Macrocentrus ancylivorus*, Rohw., parasitised 44 per cent. of the twig-infesting larvae, the highest parasitism recorded in this district. In the past 2 years, 10,000 individuals of 9 species of foreign parasites have been liberated against *C. molesta* in western New York. On quince [*cf.* **22** 300], about 90 per cent. control was given by sprays of 2½ lb. lead arsenate with 1 U.S. gal. summer oil, lead arsenate alone, and 1 U.S. gal. summer oil with 1 U.S. pt. nicotine sulphate, all in 100 U.S. gals. spray.

Tests showed that coal tar distillate sprays caused a slight decrease in the set of fruit on weak trees, but no decrease on healthy ones, provided that the concentration was not greater than 5 per cent. Water gas tar oil, which in 1934 was cheaper than coal gas tar oil, was found as effective in sprays against apple Aphids, the black cherry aphis [*Myzus cerasi*, F.], and the pear psylla [*Psylla pyricola*, Först.], and caused no injury to apple, pear and cherry.

A nicotine sulphate spray during the calyx period gave 95·2 per cent. control of *Lygidea mendax*, Reut., on apple; when it was applied 11 days later, 59·6 per cent. control was obtained. Releases of *Hippodamia convergens*, Guér., against the rosy apple aphis [*Anuraphis roseus*, Baker] and the pea aphis [*Macrosyphum onobrychis*, Boy.] gave disappointing results because of the rapid dispersal of the Coccinellids

from the point of liberation. The lesser peach tree borer [*Aegeria pictipes*, G. & R.] was controlled by painting the injured areas with a mixture of 2 lb. paradichlorobenzene in 1 U.S. gal. crude cottonseed oil. Branches should not be completely ringed with this paint or injury may occur. When entire peach trees are seriously weakened by the shot hole borer [*Scolytus rugulosus*, Ratz.], they should be destroyed. Otherwise infested limbs may be removed, the stump heavily whitewashed and the tree fertilised to stimulate growth.

Larvae of *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., again injured the roots of hemlock [*Tsuga*] and spruce, and the adults caused serious damage to arbor-vitae [*Thuja*] by girdling the branches. Spraying the foliage with calcium arsenate (4 lb. to 100 U.S. gals.) reduced the number of weevils, but not so much as a bait of 2 U.S. gals. molasses, 6–8 lb. calcium arsenate or sodium fluosilicate, 8–10 U.S. gals. water and 100 lb. bran. Since the emergence period of the weevils is long, this should be applied twice, at the peak of emergence and when all have emerged. Experiments on the control of the gladiolus thrips [*Taeniothrips simplex*, Morison] showed that dipping gladiolus corms for 2 hours at 110°F. in solutions of mercury bichloride (1–1,000), mercurous chloride (1–500), a mixture of these two, and mercuric oxide (1 oz. to 1 U.S. gal.) caused some retardation of growth, but the final percentage of corms that sprouted was about the same for each material. More plants died from dry rot before maturing when the corms were dipped in water alone than when chemicals were added.

VESEY-FITZGERALD (D.). **The Incidence of the Large Moth Borer, *Castnia licus* in Wild Plants in Trinidad.**—*Trop. Agriculture* **13** no. 2 p. 37, 6 refs. Trinidad, February 1936.

Records of food-plants of *Castnia licoides*, Boisd. (*licus*, auct.) are discussed from the literature, with particular reference to its discovery in British Guiana in 1930 on *Heliconia bihai*, on which the larvae were attacked by *Zenillia palpalis*, Aldr. [*cf. R.A.E.*, A **19** 627; **20** 547, 568]. Though species of *Castnia* have been recorded from a wide range of plants and *C. licoides* in particular has been found on palms and sugar-cane, Musaceae and Zingiberaceae are probably the primitive food-plants.

Records in Trinidad show that *C. licoides* is attached to plants belonging to unstable communities under conditions of only moderate shade, though it extends into more stable plant associations in the absence of shade. This might account for its establishment on sugar-cane, which is in effect an unstable plant community growing under conditions of moderate shade. Musaceous food-plants in Trinidad are *Heliconia bihai* and *H. humilis*, which are not tolerant of heavy shade and are common in cacao plantations and abandoned cultivations, *H. psittacorum*, which covers large areas of wet savannah and colonises the floor of open second growth forest and coconut plantations, being followed by *C. licoides* throughout its range, and *H. pulverulenta*, which belongs to established forest and is rarely attacked. Zingiberaceous food-plants include *Renealmia bracteosa*, which occurs in poor, light soil in sheltered clearings, and in rare cases *Costus* sp. and *Ishnosiphon arouma*. Other genera of the same family more characteristic of the shady floor of established forest are not favourite food-plants.

Porter (C. E.). **Breve nota entomologica economica.**—*Rev. chil. Hist. nat.* **37** p. 95. Santiago, Chile, 1933. [Recd. February 1936.]

Coccus hesperidum, L., attacking roses, and the Halticid, *Dibolia decorata*, Blanch., attacking wheat in the ear, are recorded in Chile.

Elgueta P[rado] (N.). **Notas preliminares sobre larvas chilenas.**—*Rev. chil. Hist. nat.* **37** pp. 260–262. Santiago, Chile, 1933. [Recd. February 1936.]

Rodolia cardinalis, Muls., which was introduced into Chile in 1931 against *Icerya purchasi*, Mask., has been found, experimentally, to prey on the eggs and larvae of *I. palmeri*, Riley & Howard. A Dermestid larva has been found feeding on the pupae of *Cydia* (*Carpocapsa*) *pomonella*, L.

Elgueta Prado (N.). **Las moscas de la fruta en Chile.** [Fruit-flies in Chile.]—*Rev. chil. Hist. nat.* **39** pp. 66–67. Santiago, Chile, 1935. [Recd. February 1936.]

In this paper are collated the records of fruit-flies in Chile made by Kisliuk & Cooley [*R.A.E.*, A **22** 222] and by Greene [**22** 538].

Progress Reports from Experiment Stations Season 1934–35.—Med. 8vo. 4+144 pp. ill. London, Empire Cotton Growing Corp., 1936. Price 2*s.* 6*d.*

The pests of cotton occurring in Africa during 1934–35 are discussed as in previous years [*cf. R.A.E.*, **22** 224; **23** 249]. F. S. Parsons (pp. 24–30) reports the results of continued observations on the bollworms, *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Diparopsis castanea*, Hmps., in the Barberton, Magut-Pongola and Swaziland areas. A survey of the Barberton area, which was extended to include a citrus and market garden 30–40 miles distant, to some extent confirmed the belief that degrees of infestation on any individual farm are generally governed by opportunities for winter-spring breeding on ratooned cotton. There was no evidence in most cases of movement of moths between farms as exemplified by egg-counts on crops and weeds. On the comparative basis of numbers per crop area, infestations of the past two years on winter-spring crops in Barberton and Magut-Pongola have many times exceeded the summer infestations, generally supposed to be numerically the greater. As drought and virus disease were limiting factors, it remains to be ascertained whether, where irrigated crops are available, the main period of bollworm activity habitually falls at the time of year indicated. By the end of the 8–10 weeks that intervene between the cessation of infestation in irrigated crops and the presence in flower of rain-grown crops, most moths produced in winter crop lands have emerged, and in the absence of food-plants a decline in the population ensues except where irrigation water has given a start to very early maize. At Barberton and Magut the first generation in unirrigated summer crops is due to late emergence of moths from the winter-spring breeding grounds, as well as from pupae carried over from the previous summer, whereas in Swaziland it is assumed that this generation is initiated entirely by moths from overwintered pupae. The presence of flowering weeds and ratooned cotton prolongs the period of summer attack, and a second, but smaller, generation is

produced on early rain crops. Tobacco also contributes to this brood, but only to a slight extent, as larval survival on it is very small. In the past two seasons two plantings of trap maize were sufficient to protect cotton against the first generation, except where emergence from ratoon cotton had also to be dealt with. In the latter case 3 plantings within the first 6–8 weeks of the planting season were required to divert the moths of the first main flight to maize. Maize plantings were continued sufficiently late to provide for the possibility of a second, frequently larger, generation in March, and a third generation in April–May, which, however, owing to drought or larval disease, may not occur.

The virus disease attacking the larvae, which has been diagnosed as polyhedral or wilt disease [*cf.* **4** 420], has been readily transmitted to laboratory-fed larvae through food treated with filtrate, and is carried into the pupal stage, reaction bodies having been detected in 90 per cent. of the pupae from larvae collected in November 1934.

With a view to alteration of planting dates, now made possible by irrigation, a study is being made in Swaziland on the relation between *D. castanea* and its two principal natural food-plants, *Cienfugosia hildebrandtii* and *Gossypium obtusifolium*, with special reference to the influence of soil moisture and temperature on moth emergence in the dry season.

E. O. Pearson (pp. 30–35) records investigations on *Dysdercus* spp. and internal boll disease, including a survey of the distribution and abundance of *Sterculia rogersi*, the most important tree host of the stainers in Swaziland and the eastern Transvaal [*cf.* **23** 250]. In the Barberton district, observations were made at several points representing the changing conditions between middle and low veldt. At three of these points the *Sterculia* crop set was infested by a larva previously thought to be a Cossid, but which has now been determined as the Noctuid, *Characoma nigripennis*, Hmps., to such an extent that very little matured and the stainer population was small. At the point nearest Barberton, on the other hand, the seed crop matured, although only 12 per cent. of that set, was one of the heaviest ever known. As the result of these observations, doubt has been thrown on the hypothesis that in years of abundant fruiting an F_2 generation of stainers is matured on the trees in February, the adults of which constitute the main migration to plant cotton. It was clear that F_1 adults left the trees despite an abundance of food-supply soon after the final moult, and that a further link between *Sterculia* and plant cotton is still to be sought.

Records from three previous seasons have shown that during January and February migrant adults, chiefly *D. nigrofasciatus*, Stål, commonly appear on perennial malvaceous plants then fruiting. Careful search made during mid-January near *Sterculia* colonies where F_1 adults were suspected of having left the trees after moulting, showed the presence of newly-moulted adults of both *D. nigrofasciatus* and *D. intermedius*, Dist., on *Hibiscus* bearing green or recently opened capsules. During late February, a generation of stainers was maturing on these plants. In previous years it has also been noticed that stainers, especially *D. nigrofasciatus*, have appeared from mid-January to mid-February in ratoon cotton, which occupies much the same ecological position as perennial malvaceous plants. Ratoon cotton was again invaded in January 1935 by large numbers of *D. nigrofasciatus* and smaller numbers of *D. intermedius*. It thus appears possible that the time between the maturing of adults on *Sterculia* and their appearance on plant cotton

in late February and March is probably spent on wild or cultivated perennial malvaceous plants.

In 1935 when the methods employed in recording were substantially the same as in 1934, *D. intermedius* was rare except in one field of ratoon and *D. fasciatus*, Sign., as in every season since 1932, appeared in small numbers only in plant cotton. The continued failure to find *D. fasciatus* in quantity on any wild food-plant other than baobab [*Adansonia digitata*] in the northern Transvaal, coupled with its almost invariable association with badly ratooned cotton, strengthens the suspicion that the outbreak years of 1931–32 were connected with the presence of abandoned cotton. *D. nigrofasciatus* occurred in the smallest numbers ever recorded on non-irrigated plant cotton in all districts, probably owing to abnormally late boll opening coupled with very dry conditions from February onwards. One sudden heavy infestation of fifth instar nymphs occurred in northern Swaziland following the sudden drying up of *Hibiscus trionum* in fallow land immediately adjoining cotton. Moderate infestations occurred in semi-irrigated fields in the Magut area. Infestation by *D. nigrofasciatus* in ratoon cotton in the Barberton area was very much higher than in plant cotton, and in one case was probably derived direct from *Sterculia* in January, dry conditions from February onwards stimulating an exodus of the adults produced.

Adults of *D. nigrofasciatus* and *D. intermedius* drawn from both migrant and F_1 generations on *Sterculia* were found to be carrying *Nematospora gossypii*, 13 per cent. being infected. *N. gossypii* was abundant in the seed of *Sterculia* fruits examined. Adults of *Odontopus confusus*, Dist., a Pyrrhocorrid that passes its whole existence on *S. rogersi*, was found to be heavily infected with *N. gossypii*, which may be carried over by it from one season to the next.

J. E. Peat (pp. 50–60) reports from Southern Rhodesia that *Heliothis armigera*, caused less obvious injury than in previous years owing to natural shedding caused by drought, though most growers suffered more or less severely. At Gatooma the time of planting of all crops other than cotton was regulated to reduce oviposition. Commercial maize was planted later than usual, over the middle fortnight of December, to give tasselling protection through February, and late blocks of trap maize were planted at the end of December and beginning of January. Kaffir corn [*Sorghum*] and sunflowers were also planted so that their flowering would attract the moths. In one block maximum oviposition, which coincided on commercial maize and cotton, was 4,000 eggs per acre a day on both of these crops, but later reached 6,500 on trap maize. In another block the corresponding figures were 6,000 and 8,500. It appears that oviposition is spread over all crops flowering at the same time, maize at the tasselling stage being only slightly more attractive than cotton that is flowering freely. Tobacco in flower, however, seems to be considerably more attractive. Without the addition of crops other than cotton in flower during February and early March, the moth population, which up till that time has been scattered through large acreages of commercial maize, tends to concentrate on smaller acreages of cotton coming into full flower. Although the amount of oviposition by *H. armigera* was very small compared with 1934, egg survival was much greater and larvae were almost as numerous. Natural parasitism by *Trichogramma luteum*, Gir., was much less.

Oviposition by *Diparopsis castanea* in a standover block of cotton began to be noticeable early in November 1934 and increased after

mid-November, 40 eggs to 100 plants being laid daily from then until mid-December, and fewer afterwards. These records were confirmed by observations in which the main period of emergence of moths from pupae in cages was during the last two-thirds of November and throughout December. For the last two years the standover cotton has been used as a trap crop and has been stripped at intervals to destroy the eggs. Probably as a result, oviposition on the annual cotton has been low ; in 1935 it was negligible until late in March and the peak at the beginning of April was under 30 eggs per 100 plants per day.

In the south-eastern corner of Southern Rhodesia (Sabi Valley), cotton is being experimentally grown under irrigation, and, in view of the low altitude, under conditions differing from those prevailing elsewhere. *Adansonia digitata*, *Sterculia* and other food-plants of *Dysdercus* are abundant there, as well as wild cotton. Cotton crops planted between July and December are heavily attacked by *Dysdercus fasciatus*, with small populations of *D. intermedius* and *D. nigrofasciatus*, and by *Diparopsis castanea*. Oviposition by *Diparopsis* had become negligible in 1935 by the beginning of April, and *Dysdercus* had also become less numerous. In mid-October, crops planted in February–March were only lightly infested with *Dysdercus* and oviposition by *Diparopsis* was negligible. A crop of clean cotton had already been picked, and most of the bolls were free from staining. It may be possible to grow cotton under irrigation, planting in February and March and reaping from September to November. Observations of alternative food-plants of *Dysdercus* show the most important to be *Adansonia digitata*. Wild cotton and, to a smaller extent, *Thespesia* are food-plants of *Diparopsis*.

A. G. Bebbington and W. Allan (pp. 61–67) report work on cotton at Mazabuka, Northern Rhodesia, where defoliation of the maize crop in late January and early February 1935 by flying swarms of *Nomadacris septemfasciata*, Serv., probably affected oviposition by *H. armigera*, damage by which was negligible.

The host sequence of *D. superstitiosus*, F., at Mazabuka was the same as in the previous season, but the wandering population was first observed in December 1934 as compared with November in previous years. Concentration on *Thespesia rogersi*, without breeding, was followed by migration in late December to *Hibiscus trionum*, where a single generation was bred before the plants dried up in February. The first appearance on cotton coincided with migration from *H. trionum* and a decline in the population on cotton occurred when the later hosts, *Hibiscus asper* and *H. cannabinus*, flowered in late March and April. Records of the distribution of *Dysdercus* on cotton and wild food-plants are shown for three areas and compared with records from Mazabuka. Where *H. trionum* is absent, *D. superstitiosus* is rare, and the abundance of *D. fasciatus* is similarly governed by the presence of *T. rogersi*.

H. Marsland (pp. 105–118) reporting from the Mpanganya experiment station, Tanganyika, states that *Platyedra* (*Pectinophora*) *gossypiella*, Saund., was the most troublesome pest of the season and, combined with *Dysdercus* sp., caused diminished yields. Damage by *Helopeltis* was fairly general, and there was a recrudescence of *Apion* [? *xanthostylum*, Wagn.] in the Morogoro district. As *Hibiscus esculentus* seems to be the only alternative food-plant of *P. gossypiella* in Tanganyika, where long-cycle larvae do not occur, it should be possible to effect control by strict sanitation between seasons. Another species of *Platyedra* was

found on Kidney cotton in the Western Province, where *Plemyristis oenochares*, Meyr., was also recorded for the first time in Tanganyika. *P. oenochares*, however, attacks only bolls that have already opened and is of little importance. Injury due to Capsids, mainly *Lygus* sp., occurred in the Lake Victoria shore area.

H. C. Ducker, W. L. Miller and S. T. Hoyle report from Domira Bay, Nyasaland (pp. 113–119), that owing to the drought in February and March there was more damage by *Dysdercus* than ever before recorded. Wild plants, including *Hibiscus* sp., had dried up before the April flowering of cotton, which was considerably attacked. Infestation by *D. intermedius* rose to 1,500 adults per acre at the end of May and then fell off, but *D. fasciatus*, after at first following the same course, further increased and rose to a maximum at the end of June with a population of 4,000 adults and 8,000 fifth-instar nymphs per acre. *D. superstitiosus* was recorded in small numbers, and *D. nigrofasciatus* was observed twice. The drought and changes in sowing dates of other attractive crops, due to resowing following locust attack, were probably responsible for the presence of *H. armigera* on cotton in unusual numbers. *Diparopsis castanea* was normally abundant. Records of oviposition of both species were smaller than would have been expected from the amount of damage done.

JOURDAN (M. L.). *Eurygaster austriaca*, **parasite des blés au Maroc.**—*Rev. franç. Ent.* **2** fasc. 4 pp. 196–204. Paris, 20th January 1936.

This is a more detailed account than one already noticed [*R.A.E.*, A **24** 217] of the bionomics of *Eurygaster austriaca*, Schr., which damages wheat in Morocco. The immature stages are briefly described. The adults pair 2 or 3 weeks after coming out of the winter diapause, lay eggs and then die. Oviposition takes place at irregular intervals over a period of 3–4 weeks; with a few individuals it lasted 2 months. The egg stage varied from 16 days in April to 5 in June 1934. In the laboratory the adults shelter singly under leaves, straw or moss or in earth before entering a diapause. The adults do not migrate, except occasionally from one field to another when disturbed. The bugs feed on the green stems and leaves and also on the grain, but appear to leave it as soon as it ripens. They were reared from egg to adult in the laboratory on the leaves of graminaceous plants, but when given lump sugar also they became stronger and there was less mortality. In studies with poisoned bait, bugs fed on sugar soaked in a 2 per cent. solution of sodium arsenite died within 4 days.

The first generation of the parasite, *Clytiomyia helluo*, F. [*cf.* **24** 189] develops in about 45 days and the succeeding ones in 30–35.

CHIAROMONTE (A.). **Servizio fitopatologico e questioni entomologiche nelle nostre Colonie.** [The Phytopathological Service and entomological Questions in our Colonies.]—*Atti Accad. Georgof.* 1935 no. 1–2 reprint 31 pp. Florence, 1935.

In this lecture the author reviews the development of the organisation of the colonial phytopathological services in Libya, Italian Somaliland and Eritrea, indicates the lines on which the work should be extended, and surveys the major entomological problems requiring investigation. Anti-locust research is one of great importance, and a brief account is given of existing work on this subject.

Lefevre (P.). **Etude sur** *Busseola fusca* **Hmpsn. parasite du maïs.**—*Bull. agric. Congo belge* **26** no. 4 pp. 448–452, 1 fig., 3 refs. Brussels, December 1935.

Busseola fusca, Fuller, attracted attention in February 1935 by the severe damage it caused to maize in several localities in Ruanda-Urundi (Belgian Congo). The larvae bore in the stem, travelling toward the base, but if they encounter a node too hard to penetrate, they leave the stem and enter it again lower down or occasionally pass to a fresh stem. They often enter the cobs where they eat the milky seeds. Their presence can be detected by the excrement projecting from the entrance or exit holes of their mines. They pupate after 5–6 weeks within the stems, or more often in the cobs, and the adults emerge about 16 days later. Larvae, pupae and adults are briefly described. Larvae are present in the greatest numbers in February and pupae and adults in March. *B. fusca* is most abundant in sheltered hollows, heat and moisture being the conditions favourable to its development. Temperatures for each month in the year are shown for each of the 4 localities where it was injurious, showing that it can withstand a minimum of 10·7°C. [51·26°F.] and a maximum of 28·6°C. [83·48°F.].

Reference is made to experiments against the stalk borer in South Africa [*R.A.E.*, A **22** 79, 557], and the following control measures are recommended : deep cultivation immediately after harvest and burning of crop remnants or burying them to a depth of more than 6 inches to prevent the adults emerging ; destruction of the thick stalks of any graminaceous plants growing near the fields, and, during the growing season, of any maize plants or parts of plants seen to be infested ; and " top dressing " with derrisol (1 : 150) at the rate of 10 cc. per plant [*cf.* **19** 57].

Soyer (D.). **La chenille enrouleuse des feuilles du cotonnier** *Sylepta derogata* **Fab.**—*Bull. agric. Congo belge* **26** no. 4 pp. 496–498, 2 figs. Brussels, December 1935.

In view of the abundance of *Sylepta derogata*, F., on cotton in the Belgian Congo, brief descriptions are given of the larva, pupa and adult and of the injury caused. An infested plant is easily recognised by its rolled leaves. The larvae do not move far from the point of oviposition and remain grouped around one centre on the plant. Injury is only serious when the larvae are numerous and destroy sufficient foliage to hinder the development of the plant. In order to avoid this, all larvae seen early in the season should be destroyed. When newly-hatched, the young larvae live in groups within a rolled leaf, but later each rolls a separate one. The larva often drops to the ground when a leaf is pulled off, thus escaping destruction. Pupation takes place either in the leaf or on the ground. The larval stage lasts 16–29 days, the pupal stage 10 and the total life-cycle 30–50. In addition to hand collection of the larvae, clean cultivation and early planting to avoid infestation, the moths can be caught at light traps and sprays of lime and Paris green or lead arsenate and soap may be applied.

Notley (F. B.). **Coffee Thrips. A Contribution to our Knowledge of the Cause of Outbreaks.**—*E. Afr. agric. J.* **1** no. 4 pp. 283–292, 7 figs. Nairobi, January 1936.

Though outbreaks of *Diarthrothrips coffeae*, Will., on coffee in Kenya have been attributed in the past to drought, the thrips only caused

slight injury in 1933 when drought affected the trees severely. Moreover, in 1935 a severe infestation occurred in March after heavy rainfall (5–10 ins. in 2 areas) in February. In a district that did not receive any rain in February and where the drought was severe, the infestation was not so heavy. An examination of the meteorological data and the incidence of the thrips during 1932–35 indicates that outbreaks are closely correlated with the average mean monthly temperatures. Slight infestations occurred when the mean monthly temperature exceeded 65°F. for four successive months, and a severe outbreak in 1934–35, when the temperature was above 65°F. for six months. No direct correlation was found between the incidence of the thrips and either atmospheric humidity or rainfall. The infestation invariably disappeared when there was a marked drop in the temperature, and coffee growing at higher altitudes is generally not attacked. Outbreaks usually occur earlier and are more serious on trees growing on the leeward side of slopes and of windbreaks, where the temperature is higher, and on poor soils. By recording the average mean monthly temperatures, it should be possible to forecast a probable attack at a very early stage. As the temperatures in January–March and probably in April are high enough to encourage thrips but are not alone sufficient to cause a severe outbreak, the temperatures in November and December are critical. If the average temperatures in these two months are above the normal, an outbreak may be expected, and the trees should be sprayed with lime-sulphur (1°Bé) in January. The trees can be rendered less susceptible to attack by avoiding unnecessary windbreaks, by spaced planting where the soil is dry, and by improving the water content of the soil.

STOREY (H. H.). **Virus Diseases of East African Plants : III. Rosette Disease of Groundnuts.**—*E. Afr. agric. J.* **1** no. 3 pp. 206–211, 2 figs., 13 refs. Nairobi, November 1935. **IV. A Survey of the Viruses attacking Gramineae.**—*T.c.* no. 4 pp. 333–337, 9 figs., 9 refs. January 1936.

Much of the information in the first paper has already been noticed [*R.A.E.*, A **16** 336]. The rosette disease of ground-nuts (*Arachis hypogaea*), which was first recognised in Tanganyika, has now been found to be present in tropical and southern Africa wherever ground-nuts are grown. All varieties are susceptible. Besides the typical form of rosette disease there are various other forms, which may be caused by variations in the degree of virulence of strains of the virus. *Aphis laburni*, Kalt. (*leguminosae*, Theo.) is the only known vector. Natural enemies of this Aphid [*cf.* **22** 197] include predacious Syrphid larvae in South Africa, and a fungus, *Entomophthora aphidis*, in Uganda, where it is probably the chief natural controlling agent. Its activities are apparently favoured by the ecological conditions produced by a close cover over the ground and this probably accounts for the improved condition of plants closely spaced, although it is possible that close planting increases the resistance of the plant to the virus in some way. It is recommended that all ground-nut crops should be planted early and as nearly as possible on the same day throughout the district and also planted closer together (9 × 9 ins.). During the early growth of the young plants, the soil can be mulched with dry grass [**21** 106] or weeds encouraged to form a close cover.

In the second paper the virus diseases that attack graminaceous plants in East Africa are briefly surveyed. They are classified according to the type of symptoms they produce. The mosaic group includes the common virus disease of sugar-cane, which can be transmitted to maize and certain varieties of *Sorghum* and many wild grasses. Several strains of this virus have been recognised in the United States and in the Transvaal [**18** 133]. All are transmitted by *Aphis maidis*, Fitch, and also, with some difficulty, by inoculation. The Agaul variety of sugar-cane, which was imported into Natal from India, is now found in South and East Africa entirely affected with a mosaic disease typical of the mild symptoms of the common one. Attempts to transfer the virus by *A. maidis* and by inoculation were unsuccessful, and there is no evidence that it spreads naturally to other varieties in the field. Under the streak group are classified diseases that produce streak of maize, sugar-cane and various wild grasses. There appears to be a specific strain of virus for each host [*cf.* **19** 134]. All are transmitted by *Cicadulina* spp. but not by inoculation. In 1929 streak disease was reported in Mauritius on the R.P. 8 variety of sugar-cane. A diseased plant of this variety was recently intercepted in quarantine. Although the symptoms were typical of the common streak disease, attempts to transfer the virus to maize and healthy plants of the same and other varieties of sugar-cane by *Cicadulina* spp. and *Peregrinus maidis*, Ashm., were unsuccessful. Stripe disease of maize, which has only occurred in the Amani district, resembles streak in its symptoms but differs from it in that it is transmitted only by *P. maidis* [*cf.* **21** 106]. It is not known to be transferable to other plants in East Africa. A new disease of maize resembling mosaic was produced when leafhoppers of the genus *Cicadulina* were allowed to feed on maize seedlings. As the symptoms disappear when the plant grows older, it has not been diagnosed with certainty on plants in the field. The virus is transmitted by the same species of *Cicadulina* as transmit streak disease. It may be an unusual strain of the virus that causes streak, but from experiments and the general character of the symptoms this seems unlikely. It affects the growth of the plants very little.

Chu (Joo-tso). **Biological Investigation on the indigenous Mulberry Silkworm** (*Theophila mandarina* **Moore**). [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 126–140, 9 figs., 16 refs. Hangchow, 1935. (With a Summary in English.)

An investigation on *Bombyx* (*Theophilia*) *mandarina*, Moore, which is one of the most destructive and widely distributed pests of mulberry in China, was carried out in Wusih in 1929–31. It has 4 generations a year and overwinters in the egg stage, the overwintering eggs hatching about mid–April. The first eggs of the 4 generations were deposited in mid-June, late July, late August, and early November, respectively, the average number laid by a female being 310, 194·5, 289 and 338·63, and the percentages that hatched in the laboratory 92·87, 62·58, 73·15 and 81·22. The eggs were laid on the leaves, twigs or branches between 5 and 9 p.m. In each generation some of the larvae had 4 instars and some 5. The larva ate an average of just over 3 gm. of leaves during its total feeding period. Pupation takes place in a cocoon in folds of the leaves.

Parasites reared were *Telenomus* sp. from the eggs, *Brachymeria obscurata*, Wlk., and *Pimpla luctuosa*, Smith, from the pupae, and *Tricholyga sorbillans*, Wied., from the larvae.

Chu (Joo-tso). **A List of the Mulberry Insects of China.**—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 152–179, 86 refs. Hangchow, 1935.

Most of the 170 species of insects here recorded as injurious to mulberry in China were collected in Chekiang and Kiangsu between 1929 and 1934. They are arranged in systematic order, and brief notes on their world distribution and food-plants and in some cases the time of their appearance in the field are included.

Vinson (J.). **Report on the Operations for the Control of *Phytalus smithi*, Arrow, during the Season 1934–35.**—4 pp. Mauritius, 1935.

In Mauritius, infestation by *Lachnosterna* (*Phytalus*) *smithi*, Arr., on sugar plantations has increased during 1934–35, 53·9 per cent. of the estates recording an increase and 35·3 per cent. a decrease as compared with 35·3 per cent. and 45·6 per cent. respectively in 1934 [*cf. R.A.E.*, A **23** 345]. More beetles were destroyed at a smaller cost.

During 1935, 19 species of parasites (a list of which is given) were introduced: 10 Scoliids and a Tachinid from Java, of which *Campsomeris javana*, Lep., and *C. annulata*, F., were recovered after a few months, and 6 Scoliids and a Dexiid from Madagascar. *C. pilosella*, Sauss., is now considered to be well established in Mauritius.

Lieu (K. O. Victoria). **Study of a new Species of Chinese Mulberry-borer *Paradoxecia pieli* n. sp. (Lepidoptera, Aegeriidae).**—*Notes Ent. chin. Mus. Heude* **2** no. 10 pp. 185–209, 5 pls., 4 refs. Shanghai, 20th December 1935.

Lieu (K. O. Victoria). **Preliminary Notes on the Biology and Control of the Mulberry-borer *Paradoxecia pieli* Lieu (Lepidoptera, Aegeriidae).** [*In Chinese.*]—31 pp., 3 figs. 1935. (With a Summary in English.)

The life-history of *Paradoxecia pieli*, sp. n., all stages and both sexes of the adult of which are described in the first paper [*cf. R.A.E.*, A **22** 550], is discussed from a study carried out from September 1933 to August 1935 at Hangchow and Shanghai, and from observations in various mulberry-producing districts elsewhere in China. The egg is laid exposed along the mid-rib of the lower surface of the mulberry leaf during the first half of July. The larva on hatching enters a twig through a leaf bud or the base of the petiole about the end of July. Both larval and pupal stages are passed inside the twig, the adult emerging at the end of the following June. The adults live for only a few days.

In the course of rearing in the laboratory two species of Dipterous parasites were found, and it is hoped to discover some biological method of control. In the meantime borers should be removed from under the bark early in August while they are still small, or affected twigs may be cut away early in October before the larvae have burrowed far.

Fisher (R. C.). **The Habitat of** *Anoncodes melanura* **L. (Coleoptera, Oedemeridae).**—*Ent. mon. Mag.* **72** no. 861 pp. 41–42. London, February 1936.

Walker (J. J.). **Supplementary Notes on** *A. melanura* **L.**—*T.c.* p. 43.

In the first paper several further records are given of the occurrence of *Nacerda* (*Anoncodes*) *melanura*, L., in timber in England [*cf. R.A.E.*, A **24** 263]. In May 1934 larvae were found in decayed oak in a yacht that had lain for 9 months on a river bank and only floated during spring tides, and in 1935 they caused considerable damage to deal (*Pinus sylvestris*) in 2 localities. This Oedemerid has also been reported as causing extensive damage to timber piling in New York harbour and tidal estuary, where it appeared to be most prevalent at 2–4 ft. above the line of permanent saturation by the water. It is concluded that the larva is not a primary pest of sound timber, but bores in decayed wood in damp situations. It accelerates the destruction of timber in which fungus decay has already started.

In the second paper further instances are recorded of the occurrence of the beetle in England and Tasmania as well as in New Zealand, where it was found infesting the timber (mainly *Eucalyptus*) of a wharf.

Miles (H. W.). **A Revision of the British Species of** *Hoplocampa* **Hartig (Hymenoptera Symphyta).**—*Ent. mon. Mag.* **72** no. 862 pp. 58–62, 1 pl., 11 refs. London, March 1936.

A key is given to the nine species of *Hoplocampa* that occur in Britain. A brief review of available data on their habits shows that only two of them, *H. testudinea*, Klug, and *H. flava*, L., which are widely distributed and cause damage to apples and plums, respectively, [*cf. R.A.E.*, A **20** 579; **22** 1], have been studied in detail, and that little is known of the biology and distribution of the others. *H. brevis*, Klug, was first recorded in Britain in 1935, when it was found infesting pear fruits near Cambridge, but the circumstances in which it occurred suggests that it is not of recent introduction.

Smith (K. M.). **The Virus Diseases of Glasshouse and Garden Plants.**—*Sci. Hort.* **4** pp. 126–140, 8 figs., 8 refs. Wye, Kent, 1936.

Diseases caused by the viruses of tomato spotted wilt [*cf. R.A.E.*, A **23** 561], cucumber mosaic and cabbage mosaic are described under the various plants attacked by each. Diseases due to other viruses discussed are: mosaic or stripe disease of bulbous plants (narcissus and iris); breaking of tulips transmitted by *Anuraphis tulipae*, Boy., *Myzus persicae*, Sulz., and *Macrosiphum gei*, Koch; the mosaic and rosette diseases of lilies transmitted by *Aphis gossypii*, Glov.; and a virus disease of geranium (*Pelargonium*). The importance of avoiding indiscriminate mixing of different kinds of flowering plants with other crops in the frame or glasshouse is pointed out, tomato, cucumber and *Brassica* crops being particularly liable to virus infections communicable to many kinds of flowering plants. The necessity for cleansing and fumigating glasshouses before introducing other plants is insisted upon and recommendations for spraying and fumigating with nicotine are given. Plants showing unusual markings on leaves or flowers should be destroyed.

Beljavsky (A. G.). *Stylops melittae* **as a Bee Enemy.**—*Bee World* **17** no. 3 pp. 32–33, 5 figs., 4 refs. Royston, Herts, March 1936.

A brief account is given of the bionomics of *Stylops melittae*, Kirby, which normally parasitises bees of the genus *Andrena*, but is stated sometimes to attack honey bees.

Suire (J.). **Sur quelques parasites des chrysanthèmes.**—*Bull. Soc. Hist. nat. Hérault* November 1935 reprint 11 pp., 4 figs., 9 refs. Montpellier, 1935.

Brief notes are given on insects attacking chrysanthemums in France, which include the Coccids, *Pseudodiaspis* (*Aspidiotus*) *canariensis*, Ldgr., *Ceroplastes rusci*, L., and *Saissetia* (*Lecanium*) *oleae*, Bern., *Haplothrips distinguendus*, Uzel, *Thrips nigropilosus*, Uzel, *Pyrausta nubilalis*, Hb. [*R.A.E.*, A **17** 332], various Noctuids, particularly *Brotolomia meticulosa*, L., the gall-midges, *Clinorrhyncha leucanthemi*, Kieff., and *Diarthronomyia hypogaea*, Lw., *Adelphocoris lineolatus*, Goeze (*chenopodii*, Fall.), which lays its eggs in the buds and causes them to abort, *Trioza chrysanthemi*, Lw., which makes galls on the leaves, and *Aphrophora spumaria*, L.

Michel (—). **Un insecte nouveau pour l'Allier :** *Scolytus carpini* **Ratz.**—*Rev. sci. Bourbon.* 1935 no. 3–4 pp. 41–43. Moulins, 1935. [Recd. March 1936.]

In 1935 *Scolytus carpini*, Ratz., was found in logs of hornbeam [*Carpinus*] in Allier, France, apparently for the first time in this district. This Scolytid bores horizontally into the sapwood, and the main gallery may be 6·5 mm. long, 1·5 mm. wide and nearly 1·5 mm. deep. One entrance hole may serve two galleries bored in opposite directions. Larval galleries branch off from these and may be 6–12 cm. long. The sawdust removed is not consumed. The bark of infested wood is pierced with holes about 1 mm. in diameter, and also with the smaller emergence holes of an unidentified Chalcid, parasitic upon the larvae.

Rothe (G.). **Eine neue Methode zur Berechnung der Spritzbrühenmenge bei der Obstbaumspritzung.** [A new Method for calculating the Quantity of Solution when spraying Fruit Trees.]—*NachrBl. dtsch. PflSchDienst* **16** no. 2 pp. 13–15, 1 graph. Berlin, February 1936.

It is suggested that the practice, hitherto followed in Germany, of estimating the amount of spray required for a fruit tree according to its age should be superseded by a new method in which the amount of spray is determined by the circumference of the tree trunk. On the basis of experiments on apple trees, a graph and table are given showing the requisite quantities for winter spraying, which increase from 3 litres [0·66 gals.] for a trunk circumference of 20 cm. [nearly 8 ins.] to 65 litres [14·3 gals.] for one of 150 cm. [60 ins.]. For a mist spray as applied in summer about half the above quantities should suffice.

Nitsche (G.), Klee (H.) & Mayer (K.). **Befallsstärke und Ergebnisse der Bekämpfung der Rübenwanze im schlesischen Seuchengebiet 1935. II.** [The Degree of Infestation by and Results of Measures against the Beet Bug in the Territory affected in 1935 in Silesia. II.]—*NachrBl. dtsch. PflSchDienst* **16** no. 2 pp. 15–16, 1 map. Berlin, February 1936.

Supplementing an account of work done in 1935 against the beet leaf bug [*Piesma quadrata*, Fieb.] in German Silesia [*R.A.E.*, A **24** 15], particulars are given of surveys of the infestation and of the crop yields. These surveys indicate that the trap strips of beet have proved effective.

Speyer (W.). **Syrphidenlarven als Blutlausfeinde.** [Syrphid Larvae as Enemies of the Woolly Aphis.]—*NachrBl. dtsch. PflSchDienst* **16** no. 2 p. 16. Berlin, February 1936.

In the Lower Elbe districts, Coccinellids have proved valuable enemies of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] [*R.A.E.*, A **23** 705] in late summer. Observations have also shown that Syrphid larvae reduce its numbers considerably. The three species concerned were *Syrphus ribesii*, L., which was abundant, *S.* (*Epistrophe*) *balteatus*, DeG., which was fairly common, and *Pipiza dubia*, Lundb., which was found once only. The first pupae were seen on 3rd August and the last on 12th September. The pupal period of *S. ribesii* lasted 12 days at an average of 18·8°C. [65·84°F.] and that of *S. balteatus* 10–11 days at 18·6°C. [65·84°F.] and 9 at 19·5°C. [67·1°F.]. In breeding experiments most individuals developed to the adult stage by 27th September, but some remained as larvae or pupae. From early September onwards many larvae died of an unknown disease. In the literature *S. ribesii* and *S. balteatus* are recorded as preying on leaf Aphids on a number of plants, a list of which is given. Winter spraying in the orchards of the Lower Elbe districts has reduced leaf Aphids, but *E. lanigerum* has increased, and the intensified attack on it by Syrphids is possibly due to this.

Abraham (R.). **Bekämpfung von Gartenhaarmückenlarven im Wintergetreide.** [Measures against Larvae of *Bibio hortulanus* in Winter Cereals.]—*NachrBl. dtsch. PflSchDienst* **16** no. 2 p. 22. Berlin, February 1936.

With reference to the reported injury by *Bibio hortulanus*, L., to winter cereals in Prussia [*R.A.E.*, A **24** 268], it is stated that numerous complaints of similar damage by it were received at Hanover. Excellent results were obtained with calcium cyanamide as a top dressing at the rate of 180–280 lb. per acre, and the young plants were not harmed.

Andersen (K. T.). **Vorbeugungs- und Bekämpfungsmassnahmen gegen den Kornkäfer.** [Preventive and Remedial Measures against the Grain Weevil.]—*Nachr. SchädlBekämpf.* **10** no. 4 pp. 149–162, 2 figs. Leverkusen, December 1935. (With Summaries in English, French and Spanish, unpaged.)

The author dealt with the biology of *Calandra granaria*, L., in a previous paper [*R.A.E.*, A **22** 719] and here reviews the various measures found effective in Germany for preventing or controlling infestation of stored grain by it [**23** 755, etc.]

KUTTER (H.). **Die Bekämpfung der Konservenerbsenschädlinge im st. gallischen Rheintal. Untersuchungsbericht 1935.** [Measures against Pests of Peas grown for Canning in the Rhine Valley in the Canton of St. Gall, Switzerland. Report on Investigations in 1935.]—*Landw. Jb. Schweiz* **50** no. 1 pp. 80–102, 3 maps. Bern, 1936. (With a Summary in French.)

Work against the pests of peas [*R.A.E.*, A **23** 159, etc.] was continued in 1935. In accordance with expectation, *Sitona lineata*, L., was not abundant and did little harm [*loc. cit.*], though young adults were fairly numerous in June and July.

Kakothrips pisivorus, Westw. (*robustus*, Uzel) was the only serious pest. It was not observed until 7th June, but a few days later infestation was general. The thrips were most numerous (up to 8 per blossom) in places near to previously infested fields, indicating that the adults seek the nearest pea plants when they emerge from the ground. Emergence took place during a period of a few days, but as in the laboratory some second-stage larvae from June 1934 had not developed further up to August 1935, though otherwise apparently healthy, there is a possibility that some individuals have a two-year cycle. Infestation of peas on pure sand increased less than on plants on clay, and it is suggested that in sandy soil the larvae find cracks during rainy weather but that in later dry weather these openings get choked up, thus hindering the exit of the adults. A species of *Thripoctenus* was discovered parasitising the second-stage larvae ; in one batch of 25 larvae 17 contained the eggs of this Eulophid. It was present during the second half of June, but no parasitised larvae were found after the end of the month. It hibernated in the pupal stage away from its host. The larvae of *K. pisivorus* were preyed upon by Syrphid larvae.

The gall-midge, *Contarinia pisi*, Winn., was unimportant in 1935, having been reduced by its parasite, *Pirene graminea*, Hal., which in turn decreased for lack of hosts. The Scelionid, *Sactogaster pisi*, Först., was, however, more plentiful than in previous years and parasitised up to 50 per cent. of the second generation of *C. pisi*. Both *C. pisi* and *P. graminea* appear able to produce two generations a year and to have a partial two-year cycle ; the hibernated individuals emerge in two distinct series.

SCHOEVERS (T. A. C.). **Een geval van parasitisme en hyperparasitisme.** [A Case of Parasitism and Hyperparasitism.]—*Tijdschr. PlZiekt.* **42** no. 1 pp. 10–11, 2 refs. Wageningen, January 1936.

Larvae of a Calliceratid, *Aphanogmus radialis*, Kieff., are recorded as parasites of a Cecidomyiid, *Feltiella tetranychi*, Rübs., attacking a red spider [*Tetranychus*] on rose. Neither insect has previously been found in Holland.

STRONG (L. A.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1935.**—96 pp. Washington, D.C., U.S. Dep. Agric., 1935.

In July 1934, the U.S. Bureaux of Entomology and of Plant Quarantine were amalgamated, and then or shortly afterwards functions of other Bureaux concerned with plant diseases and chemical work on fungicides and insecticides were transferred to the joint Bureau. A

concise account is given of its work during 1934–35, some of which has already been noticed.

Sprays containing ground derris, cubé [*Lonchocarpus*], or pyrethrum with kaolin were ineffective against the codling moth [*Cydia pomonella*, L.] on apples. Although thiodiphenylamine (phenothiazine) was toxic to the larvae [*cf. R.A.E.*, A **23** 652] and field tests were encouraging, when used with soybean or mineral oil it injured the trees. Pine tar oil at a concentration of 50 per cent. was more toxic to the hibernating larvae than any other oil tested. Experiments in Indiana during 1934 showed that the proper banding and cleaning up of an orchard reduced infestation by 30–50 per cent. and that bait-traps reduced it by about 25 per cent. *Trichogramma minutum*, Riley, which was released against *C. pomonella* in Washington and Georgia in 1934, has not reduced the population appreciably. *Ascogaster carpocapsae*, Vier., was introduced into various localities where it had not previously occurred. Owing to the release of foreign parasites, the general level of parasitism of the oriental fruit moth [*Cydia molesta*, Busck] on peach has increased. Sprays of barium fluosilicate or synthetic or natural cryolite injured peach trees severely when applied to control the plum curculio [*Conotrachelus nenuphar*, Hbst.]. Counts to determine the effect of lime-sulphur on the San José scale [*Aspidiotus perniciosus*, Comst.] on peach are misleading unless made at least 4–5 months after the application of the spray. Burning over the margins of vineyards is a promising method for reducing the hibernating population of *Erythroneura comes*, Say, and related species. *Trichogramma minutum* was released in 1935 against *Acrobasis caryae*, Grote, on pecan and gave some reduction in certain orchards, while on a small scale it reduced the infestation of *A. palliolella*, Rag., by about 33 per cent. A sealing mixture of glucose and gelatine applied to Adriatic figs with a paint sprayer protected them from field infestation by the dried fruit beetle [*Carpophilus hemipterus*, L.]. In tests on *Citrus* in Florida, a bait-spray of 8 lb. tartar emetic and 5 U.S. gals. molasses in 100 U.S. gals. water injured the trees on repeated application, but had no ill effect if applied as a mist. In experiments in Hawaii tartar emetic was more toxic to the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] than nicotine compounds, copper arsenite, tartrate or sucrate, cadmium salts or lead arsenate. In Mexico, adults of *Anastrepha ludens*, Lw., and *A. serpentina*, Wied. survived outdoor temperatures of 22°F., but succumbed to 14°F. in 7½ hours. Infestation of *Citrus* by *A. ludens* has increased in Texas. Nine other Trypetids, including 4 undescribed species, were trapped, but none of these appeared to infest economic plants. Fewer adults of *Anastrepha* were collected on the island of Key West (Florida) and no immature stages of *A. acidusa*, Wlk., or *A. suspensa*, Lw. [*cf.* **23** 381]. There has been a considerable decrease in the area infested by the date scale, *Parlatoria* [*blanchardi*, Targ.].

The numbers of Japanese beetles [*Popillia japonica*, Newm.] trapped in western Missouri indicated an established infestation hitherto unrecorded. The area continuously infested during 1934 was greater than in 1933 by 900 sq. miles. The average density of larval population varied from 13·7 per sq. ft. in pastures to 2·3 per sq. ft. in pumpkin fields, being higher in fields with crops such as maize and asparagus on which the beetles feed readily. Bacterial diseases [*cf.* **24** 142], particularly "milky" disease, which appears to develop at above 60°F., reduced the larval population by about 20 per cent. in some localities in the spring. The efficacy of lead arsenate in killing the larvae

depends on the soil, varying directly with the amount of soluble phosphate and ammonia present, and inversely with the soluble magnesium salts. *Aserica* (*Autoserica*) *castanea*, Arrow, continued to spread, but *Tiphia asericae*, A. & J., which had been imported from Korea and liberated in three areas against it in previous years, was recovered from all of them.

Hordeum pusillum and other wild grasses are commonly infested by the Hessian fly [*Mayetiola destructor*, Say] and may serve as reservoirs for infestation of wheat. The hairy vetch Bruchid, *Bruchus brachialis*, Fhr. [*cf.* **21** 414; **23** 277], has spread into South Carolina. In North Carolina 50 per cent. of the vetch seed crop was damaged. In the summer of 1934 one of the most severe outbreaks on record of the corn earworm [*Heliothis armigera*, Hb.] occurred on maize in the central States. In Iowa 10 per cent. of the maize crop was lost, and other crops were severely injured. In the control of the pea bruchid [*Bruchus pisorum*, L.] encouraging results have been obtained by the use of border trap crops, which are ploughed under before the main crop blooms. The tobacco flea-beetle [*Epitrix parvula*, F.] appears to be controlled in seed beds and in the field with derris powders, but the cost of such treatment has not yet been determined. Barium fluosilicate [*cf.* **21** 245] and cryolite both injure the plants. Fumigation of gladiolus corms with naphthalene [*cf.* **23** 4] against the gladiolus thrips [*Taeniothrips simplex*, Mor. (*gladioli*, Mlt. & Stnw.)] at the end of the storage period retards growth and sometimes prevents germination.

Tests for the control of the cotton boll weevil [*Anthonomus grandis*, Boh.] with dusts of thiodiphenylamine and sulphur, and with derris in inert carriers gave promising results. Early morning applications of calcium arsenate were more efficient than those made at mid-day or in the evening. Equal parts of calcium arsenate and hydrated lime applied at the rate of 7 lb. per acre gave as good control as calcium arsenate alone at the same rate. Field inspection in Southern Arizona showed a very light infestation of *A. grandis thurberiae*, Pierce, on cotton that was grown where none had been planted for some years. Light infestation of cotton by the pink bollworm [*Platyedra gossypiella*, Saund.] has spread in northern Florida and in western Texas. *Pimpla* (*Exeristes*) *roborator*, F., and *Microbracon brevicornis*, Wesm., which were released against it [*cf.* **22** 355; **23** 380], are not adapted to conditions in Texas and Mexico. The former emerges too early, and the latter does not survive the winter. *M. kirkpatricki*, Wlkn., and *Elasmus* sp., received from Egypt, and *M. mellitor*, Say, and *Chelonus blackburni*, Cam., from Hawaii, were bred for release. In cage tests on insecticides for the cotton fleahopper [*Psallus seriatus*, Reut.], the best results were obtained from a mixture of 1 part Paris green with 10 parts sulphur. About 99·8 per cent. of the Capsids came from *Croton*, the principal overwintering food-plant [**21** 655, etc.], and heavy migrations to cotton occurred in June 1935. Screen tests [*cf.* **22** 635] showed considerable movement 24 ft. up in the air.

During 1934, defoliation of forest trees in New England by the gipsy moth [*Porthetria dispar*, L.] was greater than in 1933. Studies of the effect of defoliation on different trees indicated that hemlock [*Tsuga*] and white pine [*Pinus strobus*] died after one complete defoliation, and the latter suffered according to the degree of defoliation. The woodland areas concerned were composed of 5–60 per cent. (averaging about 20) white pine and hemlock, and 30–95 per cent. (averaging about 60) oaks, poplar and grey birch [*Betula populifolia*], which is the growth

most favoured by the moth. Paper birch [*B. papyrifera*], red maple [*Acer rubrum*] and other species not favoured by the moth completed the growth.

The cigarette beetle [*Lasioderma serricorne*, F.] destroyed sacks in which cotton-seed meal was stored. It was controlled by two fumigations with hydrocyanic acid gas, using 1 lb. sodium cyanide per 1,000 cu. ft. storage space for the first and ½ lb. for the second a month later. Tetrahydronaphthalene is a promising fumigant against clothes moths ; against the webbing clothes moth [*Tineola biselliella*, Humm.] it was more effective than a mixture of 75 per cent. ethylene dichloride and 25 per cent. carbon tetrachloride.

Records are given of parasites imported from or sent to foreign countries during the year. Those imported from Europe included an egg parasite, *Peridesmia phytonomi*, Gah., and two larval parasites, *Bathyplectes corvina*, Thoms, and *Tetrastichus incertus*, Ratz., against the alfalfa weevil [*Hypera variabilis*, Hbst.] ; and the egg parasite *Tetrastichus xanthomelaenae*, Rond., against the elm leaf beetle [*Galerucella luteola*, Müll.]. Insectary tests indicate that *T. xanthomelaenae* passes the winter in the adult stage, and this may explain the difficulty of securing its establishment in the United States. Field parasitism by it in southern France attained a maximum of 53 per cent. in 1935. In March 8,000 hibernating adults of *G. luteola* were forwarded from France, and dissection of samples showed 9·5 per cent. to be parasitised by *Anachaetopsis nitidula*, Rond. This Tachinid also parasitises the larvae.

Imported rice straw can be sterilised by placing the bales in a vacuum chamber, reducing the pressure, and then applying steam at 10 lb. above atmospheric pressure and holding it for two hours. The density of the bales must not be greater than 30 lb. per cu. ft. Insoluble combinations of nicotine with powdered peats (nicotine-peat) and a solid soluble by-product (nicotine humate) have been developed. The latter contained about 33 per cent. nicotine. In the natural state some peats hold up to 9·9 per cent. in a relatively insoluble form, and after a simple treatment with acid others can hold 13·7 per cent. Substituted derivatives of thiodiphenylamine (phenothiazine) proved to be less toxic than the parent substance, and similar derivatives of pyridine were unsatisfactory.

Back (E. A.) & Cotton (R. T.). **Industrial Fumigation against Insects.** —*Circ. U.S. Dep. Agric.* no. 369, 52 pp., 40 figs., 4 refs. Washington, D.C., December 1935.

In this comprehensive account of industrial fumigation against insect pests, processes are divided into warehouse fumigations on a large scale, vault fumigations for treatment of incoming material or outgoing products, bin fumigations, and vacuum fumigation. All equipment and methods are described with practical details. The requirements for the success of warehouse fumigations are discussed, and 12 pages are devoted to the use of hydrocyanic acid gas, and 4 to chloropicrin and mixtures of methyl formate or ethylene oxide with carbon dioxide. Besides these fumigants, carbon bisulphide, ethylene oxide, and carbon tetrachloride alone or with ethylene dichloride may be used in vault fumigations. Among the materials the fumigation of which is treated separately are nuts and confectionery, dried fruits, cured meats and cheeses, tobacco, flour (in both warehouses and mills),

furs and furniture. Special sections are devoted to the safeguards necessary, and directions for first aid in cases of poisoning with hydrocyanic acid gas.

Snyder (T. E.). **Our Enemy the Termite.**—Demy 8vo, 196 pp., frontis., 56 figs. Ithaca, N.Y., Comstock Pubg Co. Inc., 1935. Price $3·00. [Recd. April 1936.]

About half of this book comprises an account of the various aspects of termite biology, with special reference to the species that occur in the United States, including such subjects as the origin, distribution and development of termites, metamorphosis and castes, colony foundation, food, inquilines and natural enemies. The remainder is devoted to the damage caused to plants, stored material, and particularly timber and buildings, and to measures for preventing or controlling it, with details of the termite-proof construction of buildings. Appendices contain specifications for remedying termite damage to buildings, provisions for city building codes, and a list of the termites of the United States.

Isley (D.). **Relation of Hosts to Abundance of Cotton Bollworm.**—*Bull. Arkansas agric. Exp. Sta* no. 320, 30 pp., 7 figs., 20 refs. Fayetteville, Ark., June 1935. [Recd. February 1936.]

An account is given of the bionomics of *Heliothis armigera*, Hb. (*obsoleta*, F.) in Arkansas, where studies on its life-history were carried out from 1932 to 1934, inclusive. All stages are briefly described. It is known to attack over 70 species of plants, and a list is given of those of economic importance on which it is found in the United States. In Arkansas it damages particularly cotton bolls, maize ears, the seeds and foliage of certain leguminous crops, tomatos, and the heads of grain sorghums. It is generally distributed over the State and causes some loss of crops every year, but the amount is very variable. The cotton crop is often reduced by 2–5 per cent., and the average loss in weight of maize is probably never less than 5 per cent. and is often more with the late crop. In 1930 the most severe injury on record occurred, when the yield of practically all the late crop of maize was reduced by 25 per cent. The history of this pest in Arkansas over the last 25 years, during which there have been 9 severe outbreaks, is briefly reviewed.

The larvae may be found on various plants at intervals from early May to November. Moths from the overwintered pupae may emerge as early as 13th April, and larvae of the first generation are present on vetch and lucerne in May. Those of the second, which occur in late June and early July, damage the terminal buds of maize, and those of the third cause severe damage to cotton in August and September. The larvae that are found late in the year probably belong to a fourth generation. The generations overlap, but individuals are less abundant in the later ones. The eggs are laid singly on various parts of the food-plants, but fresh maize silks are preferred.

The methods of rearing are described ; the data, which are tabulated, were obtained by keeping some of the larvae at controlled temperatures and humidity in incubators and the rest at normal temperatures in the insectary. Many hundreds of larvae were killed by a wilt disease that occurred periodically. The egg stage varied

from 2 to 5 days according to the temperature. The rate of larval development tended to increase with a rise in temperature, but varied greatly according to the food-plant. On maize ears the larval stage averaged 17·57 days at 22°C. [71·6°F.] and 11·25 at 31°C. [87·8°F.]. The lengths of the larval stages on various food-plants at 27°C. [80·6°F.] and 30°C. [86°F.] are shown in a table. The larvae developed most rapidly on unripe maize ears (12·48 days at 27°C. and 11·33 at 30°C.), followed by maize silks and ears, cowpea foliage, maize silks, lucerne flowers, soy-beans, lucerne foliage, cotton, black medick [*Medicago lupulina*], sweet and red clover [*Melilotus* and *Trifolium*], and most slowly on the fruit and leaves of tomato (24·97 days at 27°C.). Larvae are seldom collected on black medick and sweet and red clover in the field. Larvae reared on fresh maize tassels developed about as rapidly as those on maize ears (12·67 days at 27°C.). Those reared on sprouted maize were slower (17 days), while those fed on maize seedlings less than 10 days old were slower than larvae fed on tomatos (26·5 days). The food-plants on which the larvae developed most slowly were usually those on which there was the greatest mortality. Most of the larvae fed on seedling maize died after reaching the third or fourth instar. No larvae that were fed only on the husks, leaves or stalks of maize became full-grown. The food value of the different plants affects the size of the larvae, pupae and adults; maize produced the largest. Pupae from larvae reared on 5 different food-plants varied in weight from 0·189 gm. on lucerne leaves to 0·486 gm. on maize ears. There appears to be a relation between pupal weight and adult fecundity.

The average for prepupal and pupal stages varied from 10·33 days at 32°C. [89·6°F.] to 26·69 at 20°C. [68°F.]. Development appeared to be somewhat slower (11·5 days) at 33°C. [91·4°F.] than at 32°C. The preoviposition period ranged from 1 to 8 days and was consistently shortest (average 2 days) at 28°C. [82·4°F.]. The oviposition period varied from 11 days at 23°C. [73·4°F.] to 7 at 31°C. The life-cycle from egg to egg may occupy 30 days at 28°C. or above, but it is usually longer. The number of eggs laid appears to depend more on the larval food than on any other factor ; the optimum temperature for oviposition appears to be 25°C. Moths reared from larvae fed on green ears of maize at this temperature laid an average of 1,848 eggs, which was more than twice as many as those reared on any other plant. The smallest numbers of eggs were laid by moths reared on tomatos.

These studies show that outbreaks can be built up more rapidly on certain food-plants than on others, and that a succession of these is more favourable. Cotton is not a suitable food-plant for the first generation, and therefore a one-crop system should be unfavourable. Leguminous crops and maize form a most favourable combination for the development of an outbreak. A succession of plantings of maize tends to increase damage, but that which comes into silk during the latter part of the season attracts ovipositing moths and so tends to protect adjacent cotton. In some of the States in the maize-belt it is recommended that all the maize in one locality be planted so that it comes into silk at about the same time, which should be in the interval between the abundance of moths of the first and second generations. This might reduce damage, but could not prevent it and might increase it on cotton and other late crops. In 1930, 57 per cent. of the pods of an early variety of soy-beans were injured and about half the seeds destroyed. Only 5 per cent. were injured on plants of the same variety that had matured a few days earlier. Practically all the seed crop on

the later varieties was lost. Grain sorghums that mature late are also likely to be injured.

Parasites occasionally effectively check the abundance of *Heliothis*. A total of 91 per cent. of larvae feeding on soy-bean foliage in September 1930 contained eggs of Tachinids, chiefly *Winthemia quadripustulata*, F.

Houser (J. S.). **The Annual Wheat Field Survey.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **20** no. 176 pp. 167–171, 3 figs. Wooster, Ohio, 1935.

The average infestation of wheat by the Hessian fly [*Mayetiola destructor*, Say] in Ohio increased from 15·5 per cent. in 1934 [*cf. R.A.E.*, A **23** 20] to 29·3 per cent. in 1935, and in one county it reached 67 per cent. About 4–8 times as many prepupae as in 1934 were present in the fields, since in 1935 2–4 times as many stems of wheat grew on a given area. Care should be taken not to sow wheat before the recommended date, which varies from 22nd September in the north to 5th October in the south of Ohio.

Infestation of wheat by the black wheat-stem sawfly [*Trachelus tabidus*, F.], first recorded in 1934 [*cf.* **23** 20], has spread slightly in all directions. The adults are present in the field when the heads of wheat emerge, and deposit eggs within the hollow stem a few inches below the head. The percentage of wheat infested ranged from 0·16 in east-central Ohio to 34·5 in the east. In the 92 infested fields, the infestation averaged 37·4 per cent., and in one field it reached 72 per cent. Strong plants, although infested, produced fairly good grain, probably because the stem was not severed until the grain was ripe. Losses may be minimised by recovering severed grain with a rake, and by cutting the grain early.

Marcovitch (S.) & Stanley (W. W.). **Control of the Mexican Bean Beetle by a new and improved Form of Cryolite.**—*Circ. Tennessee agric. Exp. Sta.* no. 56, 4 pp., 4 figs. Knoxville, Tenn., January 1936.

A new form of cryolite known as Alorco has been prepared by a recently discovered process giving a light, fluffy material occupying 85–100 cu. ins. per lb., and therefore twice as bulky as other cryolites, which are not well adapted for spraying or dusting owing to their weight. It remains long in suspension, adheres well to foliage and is harmless to plants. It is effective in controlling *Epilachna corrupta*, Muls., on beans in Tennessee if applied to the lower surfaces of the leaves when the larvae are very young. Spraying with angle nozzles has been shown by several years' tests to give better results than dusting. A spray of 3 lb. Alorco cryolite to 100 U.S. gals. water per acre, applied 2 or 3 times at 10-day intervals, should effect control before the pods begin to form. Spraying after formation of the pods is not recommended. If used in dust form, this cryolite should be diluted with low-grade flour, sulphur, clay, talc or road-dust, but not hydrated lime. A dust consisting of cryolite and sulphur (1 : 3) may be applied at the rate of 15 lb. to the acre with a rotary hand gun. The first application should be made to the tops of the plants against the adults to prevent oviposition. Dusting seems to be more effective against the adults of the summer generation, which are more active. If the larvae are hatching in numbers on the lower surfaces of the leaves, the dust must be directed against them where they are feeding.

Black (L. M.). **Some Insect and Host Relationships of the Potato Yellow Dwarf Virus. (Abstract.)**—*Phytopathology* **26** no. 2 p. 87. Lancaster, Pa, February 1936.

The clover leafhopper *Aceratagallia sanguinolenta*, Prov., has been found to be a vector of the virus of potato yellow-dwarf and infective examples have been collected from clover fields. Medium red clover (*Trifolium pratense*) is susceptible to the virus and is the chief food-plant of the leafhoppers. These are able to transmit the virus about 9 days after feeding on diseased plants and are capable of harbouring it from November to April. The present known range of the insect in the United States [*cf. R.A.E.*, A **21** 666] is much wider than that in which the disease is prevalent. Attempts to transmit the virus by *Myzus persicae*, Sulz., *Empoasca fabae*, Harr., *Macrosiphum solanifolii*, Ashm., and several other insects were unsuccessful.

Manns (T. F.). **Peach Yellows and Little Peach Studies. (Abstract.)**—*Phytopathology* **26** no. 2 p. 101. Lancaster, Pa, February 1936.

Of several insects tested, *Macropsis trimaculata*, Fitch, was the only one found disseminating the viruses of peach yellows and of little peach [*cf. R.A.E.*, A **23** 443, 603, etc.] A survey of many of the eastern and central States of the United States showed plums, preferably *Prunus salicina*, to be the food-plant, though this Jassid was found on many neglected peach and apricot trees. Plums were shown to be capable of carrying the viruses of both diseases. The incidence of infection was very low whether trees were exposed to many or few Jassids carrying the viruses. After trials repeated in 3 successive years, an infection of only 10–15 per cent. of peach seedlings was obtained. With the Elberta variety the infection was 25–50 per cent.

Wingard (S. A.). **Parasitism of the Apple Leaf Hopper, *Typhlocyba pomaria*, by *Entomophthora*. (Abstract.)**—*Phytopathology* **26** no. 2 p. 113. Lancaster, Pa, February 1936.

Typhlocyba pomaria, McAtee, occurred in injurious numbers in apple orchards in Virginia in August 1935. Spraying was prevented during the first week of September by almost continuous rain, after which the infestation seemed much less severe. Examination showed that the many dead leafhoppers were infested by a fungus, apparently *Entomophthora sphaerosperma*.

McGregor (E. A.). **The Texas Citrus Mite, a new Species.**—*Proc. ent. Soc. Wash.* **37** no. 8 pp. 161–165, 8 figs. Washington, D.C., 17th January 1936.

Descriptions are given of both sexes of *Anychus clarki*, sp. n., and of the characters distinguishing it from *A. banksi*, McG., and *A. rusti*, McG., between which it is intermediate. The author received specimens of the mite from S. W. Clark, who states that it has been known for over 7 years in south-eastern Texas as a pest of *Citrus*, feeding chiefly on the upper surface of the leaves and causing them to turn yellow and drop. Little webbing has been observed. The mite is most abundant in the autumn ; it appears in September, and if there are no cold periods infestation continues into the spring. It appears to be the

most important of the mites on *Citrus* in this area and to have been confused with *Paratetranychus citri*, McG., which only occurs sparingly. It may be controlled by one or two applications of sulphur dust.

Gahan (A. B.). *Brachymeria carinatifrons*, **new Species** (**Hymenoptera : Chalcididae**).—*Proc. ent. Soc. Wash.* **37** no. 8 pp. 165–167. Washington, D.C., 17th January 1936.

Brachymeria carinatifrons, sp. n., both sexes of which are described, was reared from puparia of the Tachinid, *Paradexodes epilachnae*, Aldr., parasitising *Epilachna corrupta* ab. *varivestis*, Muls., and *E. defecta*, Muls., in southern Mexico.

Muesebeck (C. F. W.). **A new Species of Parasite of** *Typhlocyba pomaria*, **McAtee** (**Hymenoptera : Bethylidae**).—*Proc. ent. Soc. Wash.* **37** no. 8 pp. 167–168. Washington, D.C., 17th January 1936.

Descriptions are given of both sexes of *Aphelopus typhlocybae*, sp. n., reared from *Typlocyba pomaria*, McAtee, in New York State.

Dozier (H. L.). **Descriptions of two new Encyrtid Parasites of Non-Diaspine Scales.**—*Proc. ent. Soc. Wash.* **37** no. 9 pp. 183–185. Washington, D.C., 4th February 1936.

Descriptions are given of both sexes of *Aenasioidea trimblei*, sp. n. reared from *Lecanium quercifex*, Fitch, on white oak (*Quercus alba*) in Pennsylvania ; and of the female of *Coccidoctonus ceroplastae*, sp. n., from *Ceroplastes floridensis*, Comst. (Florida wax scale) and *C. giganteus*, Doz., on *Ficus* spp., and *C. cirripediformis*, Comst., on an ornamental plant, in Haiti.

Malloch (J. R.). **A new Genus and Species of Muscidae from Puerto Rico.**—*Proc. ent. Soc. Wash.* **38** no. 1 pp. 9–10. Washington, D.C., 28th February 1936.

Both sexes of *Scenetes cardini*, gen. et. sp. n., a fly of the subfamily Phaoniinae, are described from specimens reared from oranges in Cuba and guavas in Porto Rico.

Bianchi (F. A.). **Investigations on** *Anomala orientalis* **Waterhouse at Oahu Sugar Company, Ltd.**—*Hawaii. Plant. Rec.* **39** no. 4 pp. 234–255. Honolulu, 1935.

In Hawaii, *Anomala orientalis*, Waterh., is only found on the Island of Oahu. It was probably introduced from Japan sometime before 1908 and was one of the most serious pests of sugar-cane until it was controlled in 1916 and 1917 by the introduction of *Scolia manilae*, Ashm. [*cf. R.A.E.*, A **5** 426]. After this it caused no damage until 1930 [*cf.* **20** 225, 572], when the larvae were found in one locality in greater numbers than at any time since the introduction of the parasite. As subsequent harvests disclosed other areas of severe damage, an investigation of the factors concerned was instituted.

Field observations showed that where the soil surface is dry and closely packed, the beetles may oviposit at any depth down to 18 inches,

but the eggs are scarce under these conditions. Concentration of oviposition occurs in recently harvested fields at the point of contact between soil and cane trash, or under the crust of mud press formed over the surface of fields where this material is sluiced on as fertiliser in irrigation water. Although among the cane itself the eggs are largely destroyed by cultural practices, many beetles develop in ditches in and around fields where mud settles in large amounts. Pairing and oviposition appear to take place within crawling distance of the point of emergence of the female. Any females found crawling, flying or feeding on flowers at greater distances from sugar-cane are invariably old and retain few eggs. Females have been observed to pair a second time on *Leucaena glauca*, and the slow rate of spread of infestation may be accounted for by the theory that a second pairing is necessary for the fertilisation of the remaining eggs and that females with only a residue of their eggs are entirely responsible for distribution.

Comparative oviposition records are shown for 16 females reared in the laboratory and 10 collected soon after emergence in the field. Eggs were laid by day or night, usually in batches of 2–12, with intervals of a day or more between the batches. The average number of eggs to a batch was 5–7 and the maximum 24. The average number of eggs produced by one female was 30–40. In most cases about 4 days passed between emergence and pairing, though one female paired and oviposited within 24 hours of emergence. The time between pairing and oviposition was normally 1–2 days. The fact that dead females occasionally contain 2 or 3 eggs suggests the possibility of a second period of oviposition stimulated by a second pairing. Van Zwaluwenburg, in unpublished data, records that out of 77 females, 34 died on the date of last oviposition, and 43 lived 1–10 days longer.

Observations in the laboratory, using large soil containers approximating field conditions, confirm conclusions drawn from field observations that migrations of the larvae are neither rapid nor extensive and are mainly governed by the presence or absence of food. The marked irregularity of the horizontal distribution of the larvae in the field may be partly due to differences in the physical characteristics of the soil, but the tendency of the females to deposit eggs near the point of emergence and the dependence of the larvae on the cane plant for food where the soil itself does not provide a satisfactory medium are probably important factors.

In the absence of grass in the cane fields the first instar larva probably feeds almost entirely on the bacterial and organic content of the soil. Although the second and third instars can attain full development without consuming food other than dead organic matter, their normal diet consists largely of different parts of the sugar-cane plant, either living or in various stages of decomposition. The fact that the larvae eat indiscriminately whatever cane material happens to be nearest, without seeking, as has been thought, the actual roots of the plant, may account for occasional discrepancies between degree of infestation and amount of damage to cane. The softer portions of the available material are most readily attacked. In the laboratory individual larvae, even from the same batch of eggs, varied considerably in their feeding habits. One larva survived 318 days without consuming a volume of food much larger than its own maximum body size.

Owing to the large amount of overlapping, it is impossible to determine the number of generations of *A. orientalis* in the field. Laboratory breeding indicates that as many as 4 may develop each year,

allowing about 90 days for each. The length of the larval stage, however, varies to an almost unlimited extent, according to environment, and there does not appear to be even one brood of definite seasonal emergence. The period of greatest abundance of adults varies from field to field and generally occurs when the cane is not more than a few months old. In some fields it continues throughout the spring and into late summer, much longer than one brood of adults with a longevity of 2–4 weeks could be expected to last, even allowing for overlapping.

When above ground, the males are more numerous than the females and can be found resting on weeds, trash or cane leaves at all times of the day. Simultaneous flights occur in response to a stimulus apparently connected with a sudden drop in temperature, such as is caused by the passing of a cloud over the sun, or at sunset, when the beetles migrate from exposed situations to shelter. Migration from shelter in the morning is effected by a series of individual flights. Flight is of short duration and erratic, often bringing the beetle back almost to the point of departure. Females on the wing behaved in a similar manner to males, and no sign of mass migration from one field to another was observed. Females sometimes congregate on flowers of *L. glauca* but always when growing in or near infested cane fields, and movement to these flowers takes place through gradual accumulation by individual flights. Females were never found further than 30 ft. from a focus of larval infestation. Tests with 6 volatile oils used in bait traps gave negative results, as although 4 of the oils, and particularly geraniol, showed some attractiveness to the female beetles, they were more attractive to *S. manilae*.

Data on the life-history in the laboratory are recorded, and the technique employed is described. The duration of the larval stage of 37 larvae that pupated varied from 82 to 266 days with an average of 172·3. The lengths of the pupal stage and adult life averaged 11·1 and 16·3 days for males and 10 and 15·5 days for females. Observations made by Van Zwaluwenburg confirm these figures, though the beetles he studied were fed on *Hibiscus* flowers, whereas in the author's experiments they were unfed.

Williams (F. X.). *Hepialus pharus* **Druce, a Moth Borer attacking Sugar Cane in Guatemala.**—*Hawaii. Plant. Rec.* **39** no. 4 pp. 292–297, 3 figs. Honolulu, 1935.

In 1934 larvae of *Hepialus pharus*, Druce, were found in Guatemala infesting the stems of sugar-cane and a number of native plants, including a large, coarse, labiataceous weed, compositaceous weeds and a malvaceous shrub, and in one case a thick-stemmed forage grass. Although generally above ground, the borings sometimes extend into the roots, one stem often containing 2 or even 3 borers. The entrance holes are protected by a curtain of frass spun together with silk. Although certain differences in the larvae, which are briefly described, suggested the presence of two distinct species, both types apparently occurring in both weeds and sugar-cane, all the moths captured were *H. pharus*, and the author believes this to be the only species involved.

The larva, which is extremely active, attacks perfectly healthy sugar-cane, chiefly along the margin of the field. The mine is commonly in the heart of the stem, until it reaches the node, where its course becomes one of more or less transverse curves, in most cases causing

breakage at this point. It is not extensive and is often within a foot of the ground, the main length of the stem being free from attack, but when two larvae were present or two parallel borings occurred in one internode, one node was sometimes traversed. The larvae were first observed in newly-stripped cane when they were already well-grown about the middle of July. Some pupated in August, and moths were seen in September and October. Only pupae were present in cane on 10th September, though larvae still occurred in the stems of weeds and shrubs, which are less succulent and nourishing. Before pupating, the larva lines the tunnel with silk. The pupa, which is described, is capable of considerable activity, travelling up and down in the pupal cell, which is about 6 inches long, and working its way to the exit hole for the emergence of the adult through the frass curtain. The flight of the moths occurs in early evening. The female lays numerous eggs, probably dropping them indiscriminately while in flight so that the larvae when they hatch have to crawl about in search of suitable plants in which to bore. Ants sometimes penetrate behind the frass curtain and attack the larvae in their tunnels. Empty puparia, probably of a Tachinid parasite, were found among the remains of a pupa of *H. pharus* in a tunnel in sugar-cane.

WEBSTER (R. L.). **Is Lead Arsenate a Failure?**—*Proc. Wash. St. hort. Ass.* **31** pp. 151–156. Pullman, Wash., December 1935. [Recd. March 1936.]

The author shows from the work on the control of the codling moth [*Cydia pomonella*, L.] on apples in Washington during the last ten years that sprays of lead arsenate alone will no longer hold it in check in the severely infested districts. It is possible that the insect has developed some resistance to chemical treatment [*cf. R.A.E.*, A **22** 88, etc.], and variations in temperature and weather conditions affect the severity of attack. The efficiency of lead arsenate is increased by the addition of high grade fish oil. The higher deposits of arsenic necessary for control were given by lead arsenate and mineral oil emulsified with oleic acid, or by lead arsenate, mineral oil and triethanolamine oleate [*cf.* **23** 274]. The use of additional materials increases the expense and the residue problem, but once infestation is reduced to a minimum, a less intensive spray programme might be adopted. As alternatives to lead arsenate, organic insecticides such as nicotine sulphate require constant renewal to maintain protection throughout August and September, since they break down more easily.

WEBSTER (R. L.). **Division of Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 325 (Rep. 1934–35) pp. 35–38. Pullman, Wash., December 1935. [Recd. March 1936.]

In experiments against the codling moth [*Cydia pomonella*, L.] on apples in Washington, heavy oils with calcium arsenate gave a larger deposit of arsenic and better control than the lighter oils. Light oils gave results comparable to medium oils when used with lead arsenate and triethanolamine oleate throughout the season. When added to lead arsenate, kerosene and triethanolamine oleate gave a somewhat better deposit of arsenic and better control than the herring oil as generally used [*cf. R.A.E.*, A **23** 274], but was inferior to light or medium summer oils with triethanolamine oleate. A low sulphonation

test light oil was not so satisfactory in the triethanolamine mixture as a higher sulphonation test light oil, but caused no oil injury even when applied 7 times to 2 varieties of apples. The addition of a small amount of alpha naphthylamine to the low sulphonation test oil to prevent injury from the unsaturated constituents appeared to lower the effectiveness of the oil. A low sulphonation test oil emulsified with bentonite gave a very poor deposit and control. Zinc arsenite coated in the spray tank with a very small amount of ferric hydrate and used with petroleum oil and triethanolamine oleate, gave an exceedingly heavy and uniform arsenical deposit, greater than that obtained with lead arsenate similarly used, and effected equally good control. Five applications of a mixture of triethanolamine oleate, mineral oil and lead arsenate against the first generation reduced the percentage infestation on apples from 80 in 1934 to 5 in 1935 without the use of any other measure except banding. This reduction was attributed to the maintenance of an extremely heavy and uniform deposit of lead arsenate and to the ovicidal effect of the oil. The deposit per sq. cm. was over 30 micrograms during the period of application and about 16 micrograms at harvest 2 months after the last application. This deposit is double that generally obtained with other sprays applied throughout the season and is easier to remove.

Preliminary studies on the substitution of ammonium hydroxide for triethanolamine in the saponification of oleic acid indicate that similar arsenic deposits and good control are obtained without noticeable injury. The best formula is approximately 3 lb. lead arsenate, $\frac{1}{4}$ lb. triethanolamine oleate or ammonium oleate, $\frac{1}{2}$ U.S. gal. mineral oil and 100 U.S. gals. water [*cf. loc. cit.*]. The deposit of arsenic increases as the spraying is prolonged, so that even the most severe infestation can be controlled.

Studies on the pea moth [*Cydia nigricana*, Steph.] indicated that about 90 per cent. of the larvae leave seed peas or dry peas before they are harvested. Green peas are gathered before the larvae are mature, and this may account for the fact that injury is not so severe in areas where no seed or dry peas are grown. *Macrocentrus ancylivorus*, Rohw., which was imported from New Jersey during the season, was reared to maturity on larvae of the pea moth in the laboratory.

Metzger (F. W.) & Maines (W. W.). **Relation between the Physical Properties and Chemical Components of Various Grades of Geraniol and their Attractiveness to the Japanese Beetle.**—*Tech. Bull. U.S. Dep. Agric.* no. 501, 13 pp., 1 fig., 10 refs. Washington, D.C., December 1935. [Recd. March 1936.]

Tests carried out in the United States during 1933 and 1934 on the use of different grades of geraniol in traps for the Japanese beetle (*Popillia japonica*, Newm.) show that the high quality generally specified is not essential for maximum attractiveness. The attractiveness of the baits was calculated from the mean percentage difference between the experimental traps and check traps for each collection, determined from field tests [*cf. R.A.E.*, A **21** 336; **22** 410]. Attractiveness is increased by the presence of a small percentage of esters and is not sensibly decreased by limited amounts of aldehydes and sesquiterpenes. No component of geraniol tested was more attractive than the recommended mixture of 10 parts geraniol and 1 part eugenol. Eugenol increases the attractiveness of geranyl acetate and citronellol, but has little effect on citronellal or geraniol

terpenes. The specifications for an efficient grade of geraniol are as follows : specific gravity at 20°C., 0·875–0·895 ; 1 part soluble in not more than 2 parts of 70 per cent. ethyl alcohol ; not more than 3·5 per cent. aldehydes present as citronellal, or 15 per cent. esters as geranyl acetate ; more than 70 per cent. free alcohol as citronellol and geraniol ; no significant deviation from the characteristic smell of pure geraniol ; not more than 5 per cent. boiling under 225°C. or 18 per cent. over 245°C. The cost of such a product would be only 40 per cent. of that of the purer grades, which are less attractive to the beetle.

BARBER (G. W.). **The Cannibalistic Habits of the Corn Ear Worm.**— *Tech. Bull. U.S. Dep. Agric.* no. 499, 18 pp., 7 figs., 2 refs. Washington, D.C., February 1936.

A detailed study of the cannibal habits of the larvae of *Heliothis armigera*, Hb. (*obsoleta*, F.) was carried out in Virginia in 1929 and in Georgia in 1930–32. From 1,000 ears of maize collected from a field in Virginia, 3,348 larvae were recovered, of which 6·36 per cent. were partly devoured. Data obtained from both States indicated that ears containing larger larvae have considerably smaller populations than those containing smaller larvae. The following is taken from the author's summary : In experiments in which various numbers of larvae were confined in salve-box cages, never more than one individual in each cage became full-grown and pupated. Adults were reared from the egg when the larvae were fed entirely on maimed larvae, provided that the food material was kept fresh, though the time required for development was rather long. When maize silks and kernels and larvae were offered to larvae in cages, the larger larvae accepted the animal food much more readily than the smaller ones. One larva ate about 20 larvae of about its own size before pupating. As a result of successive cannibalism for several days or weeks, only one larva may remain out of the large number that entered a maize ear. Cannibalism is more rapid and extensive in ears having long, tight husks because they have fewer places at which the larvae can enter and those that do enter are brought into close contact with one another. Injury is therefore much greater in maize that is poorly protected by the husks. Cannibalism can be increased by improving the nature of the husk protecting the ears. Experiments have indicated that such improved protection would not only result in less injury to maize, but would also limit the number of larvae that develop in the field and so reduce infestation of succeeding crops.

ADAMSON (A. M.). **Progress Report on the Introduction of a Parasite of the Cacao Thrips from the Gold Coast to Trinidad, B.W.I.**— *Trop. Agriculture* **13** no. 3 pp. 62–63, 9 refs. Trinidad, March 1936.

During the last 20 years, *Selenothrips rubrocinctus*, Giard (cacao thrips) has been a serious pest of cacao in Trinidad. Few estates escape damage, and in some areas more than half the crop is destroyed. The infestation seems to be getting more widespread and severe. Spraying with Bordeaux mixture [*R.A.E.*, A **19** 244] is effective, but is not generally practised because of its high cost and the low profits obtained. The introduction of *Dasyscapus parvipennis*, Gahan, a Eulophid parasite of *Thrips tabaci*, Lind., in Java and of *S. rubrocinctus* in the Gold

Coast [**19** 378] was recommended. From four consignments of parasitised thrips and parasite pupae received from the Gold Coast between August and December 1935, about 250 adults were obtained of which about 30 were males. None of the thrips reached Trinidad alive, and no hyperparasites of *Dasyscapus* were found. From 188 parasites received in September, 7 generations, comprising about 35,000 individuals, were bred in the laboratory. The method of rearing is described. The female lays a single egg in the body of an immature thrips, which dies, usually before pupating, in about 7 days. The parasite pupates about 2 days later and remains attached by the cast-off skin of the thrips to the surface of the leaf, etc., on which the host was present. The pupal stage occupies about 10 days, and the total life-cycle about 20. Up to 70 eggs have been laid by one female. Only males were produced by parthenogenesis. Two other species of thrips were also parasitised in the laboratory.

Between November 1935 and February 1936 about 26,000 parasites (mostly pupae) were liberated in 14 localities, and adults emerged from over 90 per cent. of the pupae. At most of the points of liberation up to 100 parasitised thrips or parasite pupae were recovered within 2 or 3 weeks (in one place for up to 6 weeks) after the time of liberation.

Russell (T. A.). **Diseases and Pests of Tomatoes in Bermuda.**—*Trop. Agriculture* **13** no. 3 pp. 71–78, 1 pl., 17 refs. Trinidad, March 1936.

A brief account is given of the pests of tomatos in Bermuda. In some seasons the foliage is badly attacked by the larvae of *Psara periusalis*, Wlk. [*cf. R.A.E.*, A **14** 625], which can be controlled by adding lead arsenate or Paris green to the usual Bordeaux spray applied to the young plants. Pests of minor importance on the foliage are *Protoparce* (*Phlegethontius*) *sexta*, Joh., *Epitrix parvula*, F., *Halticus citri*, Ashm., *Empoasca fabae*, Harr., *Trialeurodes vaporariorum*, Westw., and an unidentified leaf-miner. In trials in 1934 several plants of one variety that were infested with *Tarsonemus translucens*, Green, remained stunted and their leaves failed to develop properly. Plants that were heavily dusted with sulphur recovered completely in a short time. The tomato fruits are damaged by *Phthorimaea operculella*, Zell. [**22** 253], which is the major pest in Bermuda. Much of the main crop is grown on land from which potatoes have just been dug and so becomes infested. The life-cycle of the insect on potato tubers occupied 23 days at summer temperatures in the laboratory. The fields should be cleared of potato culls before planting, and young tomato plants should be sprayed with a mixture containing lead arsenate (up to 1 lb. in 20 gals.). Other pests of the fruit are *Heliothis armigera*, Hb. (*obsoleta*, F.), and *Prodenia ornithogalli*, Gn., which also damage young plants in the seed-bed by gnawing the stem, and *Nezara viridula*, L.

Nigeria. Ordinance no. 29 of 1935. Importation of Plants Regulation Ordinance, 1935.—3 pp. Lagos, 1935.

Ordinance no. 4 of 1935. Importation of Plants Regulations 1936.—6 pp. Lagos, 1936.

The first of these Ordinances empowers the Governor of the Colony and Protectorate of Nigeria (including the Cameroons under British

Mandate) to prohibit, or place restrictions on, the importation of plants, seeds, soil, manure, containers, packing material, etc., in order to prevent the introduction of pests or diseases ; and the second comprises regulations made in accordance with it that came into force on 1st February 1936.

VAN DER MERWE (C. P.). **Measures against the Introduction and Spread of Insect Pests and Plant Diseases.**—*Fmg in S. Afr.* 1936 reprint no. 8, 4 pp., 1 fig. Pretoria, January 1936.

A brief account is given of the reasons for prohibiting the entry of certain plants, seeds, etc., into South Africa, showing how pests and diseases are introduced. The regulations governing the import and export of plants, seeds, etc., and their transport within the Union are summarised [*cf. R.A.E.*, A **12** 515 ; **23** 242 ; etc.]. Preventive measures that are carried out before despatching or after receiving plants, etc., are briefly described, with notes on the measures undertaken to eradicate any pests or diseases that have been introduced.

MARSHALL (Sir G. A. K.). **New Indian Curculionidae (Col.).**—*Indian For. Rec.* (N.S.) **1** no. 11 pp. 205–231, 1 pl. Delhi, 14th February 1936.

Descriptions are given of two new genera and 20 new species of weevils from forest trees in India, including Burma. Keys to the species of *Cryptorrhynchus* and *Himatinum* are included.

CURRIE (G. A.). **A Report on a Survey of Weed Problems in Australia.** —*Pamphl. Coun. sci. industr. Res. Aust.* no. 60, 38 pp. Melbourne, 1936.

This report begins with a brief account of the loss estimated to be caused by noxious weeds (other than prickly pear) in Australia and of general methods for their control. Investigations in progress and those recommended to be undertaken in the future are outlined. Details are given of the distribution, economic importance, and methods of controlling 20 weeds of primary importance, including work on the biological control of some of them [*cf. R.A.E.*, A **18** 464, 534 ; **22** 224 ; **24** 1] and notes on the future development of control measures.

OLDHAM (J. N.). **On the Occurrence of *Rhabditis coarctata* (Nematoda) on Caterpillars in the Marquesas Islands.**—*J. Helminth.* **13** no. 1 pp. 13–18, 1 fig., 8 refs. London, February 1935. [Recd. March 1936.]

Examples of *Rhabditis coarctata*, Leuckart, some of which were encysted, were found attached to the exoskeleton of Tortricid (Eucosmid) caterpillars which bore and pupate in the fruits of Tahitian chestnut (*Inocarpus edulis*) in the Marquesas Islands. In other countries this Nematode occurs naturally in sheep and cow dung, and the larvae normally encyst on coprophagous insects for transport to fresh dung, where they escape from the cyst and resume development. The fruits from which the caterpillars were taken were picked up from

the ground in two localities, and might possibly have come in contact with dung, but it is improbable that the caterpillars leave the fruits at any time.

SAMPSON (H. C.). **Cultivated Crop Plants of the British Empire and the Anglo-Egyptian Sudan (Tropical and Sub-Tropical).**—*Bull. misc. Inform. Kew* (Addl. Ser.) **12** viii+251 pp. London, H.M.S.O., 1936. Price 6*s.* 6*d.*

The genera and, under them, the species included in this important inventory of tropical and sub-tropical crop plants are arranged alphabetically. First the specific name is given, followed by the author, with synonyms if these are commonly used. The presumed country or countries of origin are given next, followed by the common names by which the plant is known, and vernacular names with country or language in brackets. Where necessary a brief description of the plant is given, what it is used for, and what part of the plant is useful. The countries where the crop is grown, or has been tried are next mentioned, with data as to whether it is indigenous, or an early introduction, successfully introduced, still under trial, introduced but no longer cultivated, or introduced but not established. Where known, the date and origin of the introduction are shown after the country concerned. Notes, with bibliographies, are given on a number of the more important crops, dealing with plant habits, and data on leaves, flowers, fruits, seeds, etc. An index to commonly used synonyms is appended.

WARBURTON (C.). **Annual Report for 1935 of the Zoologist.**—*J. R. agric. Soc. Engl.* **96** pp. 499–506, 3 figs. London, 1935. [Recd. March 1936.]

Among insect pests occurring in England and Wales during 1935, cutworms attacked sugar-beet in late June at Cambridge. Satisfactory control was obtained in many cases by the use of a poison bait of bran and Paris green. Insect pests of grass were unusually destructive. *Macrosiphum* (*Myzus*) *festucae*, Theo., which seldom does much harm, became a serious pest in Yorkshire and Lancashire, especially where large amounts of farmyard manure had been used, and *Charaeas graminis*, L., which appears only rarely, attacked rough mountain pastures in Brecknockshire, no damage being done below 1,700 ft. Tipulids were specially destructive during 1935, the two species concerned in attacks of agricultural importance being *Tipula paludosa*, Mg., and *T. oleracea*, L., brief life-histories of which are given. The larvae can be controlled on lawns, etc., by covering the grass with a tarpaulin at night after watering, which brings them to the surface where they can be collected in the morning. Over larger areas they can be driven to the surface by the application of various washes, the best results having been obtained with a preparation of orthodichlorobenzene with sodium oleate, and Jeyes' fluid. Where ordinary farm crops are attacked, poison baits consisting of 1 lb. Paris green, 40 lb. bran, 1 pint treacle, and 2 gals. water can be used. This quantity is enough for an acre. *Cydia pomonella*, L., was extremely abundant on apples and pears. Windfalls should be gathered frequently so that the larvae in them cannot escape, and shelter bands should be placed round the trunks in June and removed and destroyed in winter.

HAMILTON (A. G.). **Miscellaneous Observations on the Biology of *Apanteles glomeratus* L. (Braconidae).**—*Ent. mon. Mag.* **71** nos. 858–859 pp. 262–270 ; **72** nos. 860–861 pp. 24–27, 5 figs., 6 refs. London, November 1935–February 1936.

These observations on *Apanteles glomeratus*, L., were carried out in Buckinghamshire in 1932 and 1933. The females begin to oviposit in young larvae of *Pieris rapae*, L., and *P. brassicae*, L., almost immediately after emergence. Oviposition continues in the field during most of the summer and autumn. The process of oviposition and the three larval instars are briefly described ; it is possible that the instar described as the second may represent two instars. Experiments showed that second- and third-instar larvae of *P. rapae* and *P. brassicae* resist attack by *Apanteles* (sometimes successfully) by exuding green saliva and by waving their heads about. First-instar larvae were never observed to exude saliva and sometimes offered no resistance, and experiments indicated that the females prefer to oviposit in them. The number of eggs deposited in one sting varied from 15 to 27 for *P. rapae* and from 2 to 54 for *P. brassicae*.

The mature larvae of *Apanteles* emerge from the host just before it is due to pupate by eating their way out through the skin. The larval stage in the host lasted 18–23 days. A total of 2·8 per cent. of the parasite larvae did not emerge, although they had reached the final instar. In one case when the host larva was dissected, it was found that the remaining parasite larvae had been dead for some time and had started to decay, and one had partly emerged. The number of larvae in the host or the species of the latter does not appear to have any relation to the number that fails to emerge. The relationship of the larval instars of *A. glomeratus* to those of *P. rapae* and *P. brassicae* is shown in a table. Parasitised caterpillars took about the same time to reach the second and third instars as non-parasitised ones, but took longer to reach the fourth and fifth instars. The average times taken by non-parasitised larvae to reach the fourth-instar were 13·7 days for *P. rapae* and 12·4 for *P. brassicae* compared with 17 and 14·2, respectively, for parasitised larvae. The corresponding times taken to reach the fifth instar were 17·3 and 16·2 as against 20 and 19·3.

ROBIN (F.). **Les poudres végétales dans la lutte contre le Doryphore.**—*Rev. Path. vég.* **22** fasc. 4 pp. 288–297, 3 figs. Paris, 1935. [Recd. March 1936.]

In experiments carried out in 1935 in France against *Leptinotarsa decemlineata*, Say, on potato, good results were obtained with dusts containing 18 per cent. derris powder (minimum rotenone content 6 per cent.), 25 per cent. pyrethrum powder (minimum pyrethrin content 6 per cent.), and 57 per cent. clay carrier. They destroyed the adults, which are difficult to kill with sprays, as well as the larvae. Fine dusts are most toxic, and the quantity of material required is inversely proportional to the fineness. With dusts passing through a 180–200 screen, 13½ lb. is enough to treat an acre of potatoes about 2½ ft. high. The clays used as carriers are treated chemically with fatty acids to resist the action of humidity and even heavy rainfall. Dusts with such carriers remain for a long time on the plants, and thus have a protective action equal to that of sprays as well as a direct contact action. The cost of treatment does not exceed that of spraying,

and is relatively less where transport of water is difficult. The best results have been obtained with a knapsack duster, as application has to be carefully regulated in view of the small quantity of dust used per acre.

TROUVELOT (B.) & RAUCOURT (M.). **Sur la sensibilité des larves d'hyponomeutes aux sels d'arsenic.**—*Rev. Path. vég.* **22** fasc. 4 pp. 298–302, 3 refs. Paris, 1935. [Recd. March 1936.]

Wide variations in the deposit left on the foliage of fruit trees after spraying with arsenicals in France had suggested that very small quantities of arsenic might be sufficient to prevent damage by defoliating larvae. An experiment was therefore carried out with *Hyponomeuta padellus* [*malinellus*, Zell.] to determine, not the dosage toxic to the larvae, but the quantity which, distributed over the foliage, would prevent injury. Apple trees one year old were so treated with a lead arsenate spray that the average deposits of arsenic on the foliage ranged from 1 to 35 mmg. As per sq. cm. A few hours after treatment 20 third-instar larvae of *Hyponomeuta*, divided into two colonies, were placed on each tree and enclosed in muslin bags. Observations made at intervals between 4 and 26 days after the introduction of the larvae showed that a deposit of 1 mmg. arsenic afforded practical protection, the leaf surface consumed being very small, and retarded the development of the larvae. On the trees having the smallest deposits, only 6 larvae out of 40 formed cocoons as compared with 50 out of 80 larvae on unsprayed trees. The small size of the larvae renders it doubtful whether those that transform to adults could produce a further normal generation. Where the deposit was 2 mmg. or more the larvae died without pupating, though they sometimes survived for 15–25 days. A 3 mmg. deposit entirely prevented feeding, and where the deposits were 10 or 35 mmg. the larvae began to die about the 4th day, although a few lived for 15 days or more. Marchal [*R.A.E.*, A **9** 25] attributed the cessation of feeding in larvae of *Hyponomeuta* that continued to live after having ingested lead arsenate to paralysis of the mandibles, and a similar phenomenon has been observed in the case of Chrysomelids [**22** 7].

SCHONBERG (S.). **Méthode de dosage de l'arsenic contenu dans les insecticides.**—*Rev. Path. vég.* **23** fasc. 1 pp. 20–27, 2 figs., 13 refs. Paris, 1936.

An account is given of methods employed in analysing the arsenic content of insecticides and for determining small quantities of arsenic left on fruit after spraying.

WILLAUME (F.). **Action stimulante de certains traitements insecticides et fongicides sur les plantes cultivées.**—*Rev. Path. vég.* **23** fasc. 1 pp. 28–32, 7 refs. Paris, 1936.

The stimulating action on plants of sprays such as tar distillates, mineral oil emulsions or Bordeaux mixture is discussed from the literature and from the author's own work in the field and laboratory. This action, which appears to be due to an increase in the sensitivity of the plant to light, produces more luxuriant and darker foliage, larger crops of fruit and prolongation of vegetation into the autumn. The

action varies with the quality and quantity of the stimulant and according to the degree of insolation received, and may be accentuated to a point where scorching occurs.

[Golovyanko (Z. S.).] **Головянко (З. С.). The Control of the Larvae of Cockchafers.** [*In Russian.*]—Demy 8vo, 56 pp., 2 figs., 1 diagr., 10 refs. Kiev, Kolgosp. radgosp. Lit. USRR, 1935. Price 1 *rub.*

This paper contains instructions on the use of polychlorides and paradichlorobenzene against the larvae of *Melolontha hippocastani*, F., *Polyphylla fullo*, L., and other Lamellicorns, based on experiments in the Ukraine in 1926–33 [*R.A.E.*, A **18** 240; **22** 77, etc.]. It is pointed out that the number of Lamellicorn larvae per unit of soil that is dangerous in vineyards or pine plantations depends on the resistance of the plants and the conditions under which they grow [*cf.* **18** 270]. The rate of application of the fumigant depends on the type of soil and in the case of polychlorides on the toxicity of the preparation [*cf.* **22** 77]; as a rule, polychlorides are best applied in holes 14 ins. apart, but if the soil is warm and dry and there is sufficient aeration, good results may be obtained with wide spacing (28 ins.). In warm sandy soil exposed to the sun (but not in cold soils), polychlorides are more effective if the holes are 8 ins. deep instead of 4 [*cf.* **19** 111; **22** 77], or if the treated soil is covered with turf to prevent too rapid evaporation of the fumigant. The effectiveness of treatment is reduced by cold and rain so that the best time for using polychlorides in pine forests adjoining the steppe zone is the middle of June, and for the more southern districts the beginning of the month. A description is given of apparatus for introducing polychlorides into the soil, which proved to be very effective in experiments in 1933 and ensured quickness and considerable depth of application (8–12 ins.). In sandy soils in central Ukraine, the rate of application recommended (which is equivalent to about 500 lb. per acre and produced 100, or almost 100, per cent. mortality of the larvae) is 1 oz. per hole in holes 28 ins. apart and 8–12 ins. deep. Good results (93·4–99·3 per cent. mortality) may, however, be obtained with 0·2 oz. in holes 14 ins. apart and 8 ins. deep (364 lb. per acre). Polychlorides did not injure pines 2–5 years old unless introduced close to them [*cf.* **20** 145]. Vine seedlings and young deciduous trees are injured, however, and it is best in all cases to fumigate a year before planting.

The rate of evaporation of paradichlorobenzene depends on the temperature of the soil and to a large extent on the method of application, an even distribution at the bottom of the holes securing better diffusion than when the fumigant is placed in heaps. Good results may be obtained with wide spaced holes, provided that the fumigant is not heaped. Paradichlorobenzene was more effective than polychlorides at the same rate of application. Mulching the soil, covering it with turf, or introducing the fumigant at a depth of 8 ins. instead of 2, increased the effectiveness of treatment by hindering evaporation upwards. In sandy soil in central Ukraine effective control was obtained with about 364 lb. paradichlorobenzene per acre, using 0·75 oz. scattered at the bottom of holes 8 ins. deep and 28 ins. apart, or 0·2 oz. in heaps in holes 4 ins. deep and 14 ins. apart. In compact soils, more fumigant and closer spacing were required. Control was not obtained by fumigating the soil only within the radius of the root

system of young fruit trees or vines, as the roots were attacked by larvae that migrated from the untreated soil between the rows. Newly planted vine slips were killed when the fumigant (0·25 oz. per hole) was placed 1½ ins. from the slip, but when it was about 10 ins. away their development was stimulated. No injury was caused to young vines provided that the holes were not less than 5 ins. from them.

In an appendix an account is given of experiments with 5 types of polychlorides against cockchafers carried out from 29th June to 9th July 1933 in a pine forest in central Ukraine. Of the 11 species of larvae present, *Polyphylla fullo* represented 88·5 per cent. As most of the larvae were in the upper layer of the soil to a depth of 4 ins., the holes were made to this depth. During the ten days in which the soil was treated, the weather was cold and rainy, but became dry and fine from about mid-July onwards. The composition of the polychlorides tested is given. In most cases the quantities used were 500 and 364 lb. per acre. The results were estimated in September. When the holes were 28 ins. apart, 1 oz. per hole of the brownish-yellow polychlorides (which contained 66·2 per cent. orthodichlorobenzene) killed 98·8–100 per cent. ; when they were 14 ins. apart, 0·25 and 0·2 oz. killed 100 and 98·1 per cent. respectively. Dark polychlorides (containing 39 per cent. orthodichlorobenzene and 38·7 per cent. paradichlorobenzene) were similar in effectiveness. The light-brown and colourless polychlorides (66·6 and 52·3 per cent. chlorobenzene respectively) were only effective when the dosage was increased, and the greenish polychlorides were of no value.

[Yakhontov (V. V.).] **Яхонтов (В. В.). On *Aphelinus mali* Hald.—a Parasite of the Woolly Apple Aphis (*Eriosoma lanigerum* Hausm.).** [*In Russian.*]—*Sotz. Nauka Tekh.* **3** no. 9 p. 74. Tashkent, 1935. [Recd. March 1936.]

Aphelinus mali, Hald., was successfully established for the control of *Eriosoma lanigerum*, Hsm., in an apple orchard in Tashkent in September 1932. In spite of the unusually severe winter of 1932–33, parasitised colonies were found in the autumn of 1933 near the site where the parasite had been introduced and at a distance of about 76 yards from it. In 1934 a high rate of parasitism of the Aphids was observed, and in the autumn practically none occurred in the orchard, which covered an area of about 30 acres, whereas adults of *A. mali* were present in many parts. In June 1935 the parasite was found in other orchards in Tashkent, some of which were several thousand yards away.

[Sakharov (N. L.).] **Сахаров (Н. Л.). Wheat Pests.** [*In Russian.*] —*Social. Grain Fmg* **5** no. 6 pp. 151–165, 35 refs. Saratov, 1936. (With a Summary in English.)

In the Russian Union, 144 species of insects have been recorded as attacking wheat, and their joint activity causes heavy annual losses. This report comprises notes on the distribution, importance and, in some cases, bionomics of 25 species, of which the Russian names only are given, those dealt with at some length being locusts and grasshoppers, *Anisoplia austriaca*, Hbst., *Mayetiola destructor*, Say, *Oscinella frit*, L., *Cephus pygmaeus*, L., *Trachea basilinea*, F., *Euxoa segetum*, Schiff., *Toxoptera graminum*, Rond., and *Haplothrips tritici*, Kurdj.

The importance of agricultural measures that safeguard the crops from pests and raise their power of resistance to infestation is briefly discussed. Those recommended include : deep autumn ploughing to destroy hibernating larvae and pupae ; crop rotation ; manuring ; early harvesting to prevent an increase in infestation of the crop and reduce the number of self-sown wheat plants ; burning stubble ; cultivation of resistant varieties of wheat ; and sowing at dates that enable the crop to avoid infestation [*cf. R.A.E.*, A **22** 586].

[Strel'nikov (I. D.).] **Стрельников (И. Д.). Effect of Solar Radiation and Micro-climate upon the Body Temperature and Behaviour of the Larvae of *Locusta migratoria* L.** [*In Russian.*]—*Trav. Inst. zool. Acad. Sci. URSS* **2** no. 4 pp. 637–733, 16 figs., 22 tables. Moscow, 1936. (With a Summary in English.)

These studies were carried out in the summer of 1932 during a considerable infestation by *Locusta migratoria*, L., of the reed beds in the delta of the River Terek (northern Caucasus), which is one of the outbreak centres of this locust. Exact records were made of various ecological factors, in particular of solar radiation, which was measured by a specially constructed pyronometer, and of the temperature of the locusts, taken by means of thermocouples, the needle being inserted into the body of the insect. The apparatus was so constructed that six successive readings could be taken, with intervals of ten seconds.

The heating of the hoppers in sunlight was very great and rapid, for at air temperatures of 27·6–28·1°C. [81·68–82·58°F.] the temperature of a hopper kept in the shade was the same, but that of a hopper exposed to direct solar radiation of 1·07 gram-calories rose from 27·5 to 42·5°C. [81·5 to 108·5°F.] in 11 minutes. The heating effect of sunlight depends on the angle of incidence of the rays and so is greatest when the long axis of the body is at right angles to them. Wind limits the rise of body temperature, for with a solar radiation of 0·95 gram-calories, the temperature of a hopper was 45·6°C. [114·08°F.] at an air temperature of 30·5–30·9°C. [86·9–87·62°F.] and a wind velocity of 0·1 metre per second at 1 cm. above the ground, but when it was lifted 1 metre above the ground, where the air temperature was 29·5°C. [85·1°F.] and the wind velocity 5·7 metres per second, its temperature fell from 42·6 to 32°C. [108·68 to 89·6°F.] in 3 minutes. Every change in the intensity of solar radiation has an immediate effect on the body temperature ; thus when a green *solitaria* and an orange-black *gregaria* hopper were exposed to solar radiation of 1·2 gram-calories their temperatures rose to 41·3 and 44·2°C. [106·34 and 111·56°F.] respectively, but fell to 32·2 and 31·8°C. [89·96 and 89·24°F.] in 10 minutes when they were shaded. Such fluctuations, to which the insects are subjected on a sunny day with the passage of clouds, probably act on them as powerful stimulants.

Simultaneous records of the temperatures show that the dark *gregaria* hoppers absorb more radiant heat than the green *solitaria*. In the shade the temperatures of both were more or less similar and slightly higher than that of the air ; in six minutes in the sun, the temperature of *gregaria* rose by 15°C. [27°F.], and that of *solitaria* by only 10·2°C. [18·36°F.], and on being shaded *gregaria* cooled more rapidly than *solitaria*. The phases further differ in their specific gravity, as *solitaria* sinks in alcohol whereas *gregaria* floats, and the amount of air in the respiratory system is much greater in *gregaria*, as is

shown by the number of air bubbles escaping from the stigmata of hoppers compressed under water ; *gregaria* hoppers contain so much air that they float on water even after they have been completely crushed. All these differences between the two phases throw light on the differences in their behaviour, for *gregaria* hoppers can move about more easily than *solitaria*, which usually do not migrate at all, or if they start to march with *gregaria* tend to lag behind. However, the two phases live together, and in one huge migrating band *solitaria* hoppers made up 16 per cent. of the total number.

The temperature of the air in the thoracic air sac of an adult locust was found to be higher than that of the external air, but lower than that of the body by 3·6°C. [6·48°F.] in the shade and 7·4°C. [13·32°F.] in the sun. During respiration, the air sacs serve for cooling the body, for the heat generated in it by solar radiation and by the work of the muscles is given out to the surrounding medium not only from the surface of the body, but also with the air exhaled from the respiratory system, the importance of such internal heat regulation depending on the rapidity of breathing. When the air in the air sacs is warmer than the external atmosphere, it acquires aerostatic value owing to its lesser density, and facilitates the movements of locusts.

The amount of water in the body of a hopper, which in the first instance depends on food, is subject to considerable fluctuations and varies in the course of the day, as is shown by a reduction by more than a half of the weight of hoppers during the afternoon migration, as compared with the morning when they were full of water after feeding. The green *solitaria* hoppers, in which all metabolic processes are slower than in ph. *gregaria*, in general contain more water, but they also lose it after migration.

Very detailed observations were made on the diurnal behaviour of hoppers, with parallel records of the body temperatures accompanying different phases of activity, and of micro-climatic factors. In the late evening the temperature of hoppers concentrated on the tops of the reeds approaches that of the air, and later in the night becomes considerably lower. At sunrise they are warmed by the sun's rays, and when their temperature rises above 25°C. [77°F.] they begin to feed, maximum feeding activity occurring when it reaches about 30°C. [86°F.]. The vertical migration downwards begins when the rising morning wind cools the hoppers, which crawl to the intermediate level of the vegetation, where the wind is less strong, but where they can by now be reached by the rising sun. As the strength of wind increases and it penetrates deeper into the reeds, the hoppers crawl to the ground. The migration begins when the body temperature of the hoppers reaches 35–40°C. [95–104°F.]. It occurs during the hottest part of the day when the intensity of solar radiation is 1–1·24 gram-calories, and the body temperature averages 40–44°C. [104–111·2°F.]. The low relative humidity occurring at this time of day leads to the evaporation from the hoppers of large quantities of water, and this, coupled with the high body temperature, increases the irritability of the nervous system, which is an essential condition for migration. The migration ceases with the decrease of the intensity of solar radiation in the evening, and when the body temperature of the hoppers falls to 32–30°C. [89·6–86°F.] they re-ascend the plants and feed. The rays of the setting sun maintain the body temperature several degrees above that of the air, and feeding goes on until, and sometimes after, sunset, terminating at a lower temperature than that at which it begins in the morning.

When the factors determining the behaviour of hoppers, the chief of which is solar radiation, deviate from the normal, the times of different activities are altered accordingly. On cloudy days the hoppers migrate little or not at all, and if during the migration the sun is obscured by the clouds, they re-ascend the plants and feed. Hunger and thirst can induce migrations under conditions in which they do not normally occur ; thus in a band migrating from a semi-desert area with dried up vegetation towards the reed beds, groups of hoppers continued to move about after darkness and at air temperature below 22°C. [71·6°F.].

VOÛTE (A. D.). **De plagen van de djeroekcultuur in Nederlandsch-Indië.** [Pests of *Citrus* in the Netherlands Indies.]—*Meded. Inst. PlZiekt.* no. 86, 65 pp., 5 pls., 4 pp. refs. [Buitenzorg] 1935. (With a Summary in English.)

The following is taken almost entirely from the summary : This paper deals with the bionomics of 3 Coleoptera, 20 Lepidoptera, 3 Diptera, 24 Rhynchota and 2 Acarina that infest *Citrus* in the Netherlands Indies, and includes suggestions for their control. The Coleoptera are of little economic importance, and most of the Lepidoptera are leaf-eating species that do not cause much damage and may be controlled by a lead arsenate spray. *Prays endocarpa*, Meyr., which is common, causes gall-like swellings in the rind of the fruits that lessen their market value. *Citripestis sagittiferella*, Moore, is a more important pest, especially of grapefruit, attacking the pulp and causing the fruits to fall or rot. Infested fruits should be destroyed and young ones enclosed in bags if practicable. The leaf-miner, *Phyllocnistis citrella*, Stn., is a serious pest of young plants and seedlings [*R.A.E.*, A **23** 162]. The fruit-piercing moth, *Othreis* (*Ophideres*) *fullonica*, L., does not appear to be of much importance ; the larvae feed on *Tiliacora acuminata*, on which they might be collected. The 3 Diptera, *Dacus ferrugineus*, F., *Lonchaea gibbosa*, de Meij., and *Drosophila punctipennis*, Wulp, are minor pests, and few of the bugs are of real importance, though *Rhynchocoris serratus*, Dön., and *Helopeltis antonii*, Sign., are harmful in some localities. Of the Coccids, *Coccus* (*Lecanium*) *viridis*, Green, may sometimes be injurious and can be checked by adhesive bands to keep off the ants that foster it. The same measure is effective against the mealybug, *Pseudococcus hispidus*, Morrison. *Asterolecanium* sp. is locally very destructive in western Java, killing the branches. Dusting with sulphur has given excellent results against the mites, *Eriophyes* sp., which injures the fruits and *Tenuipalpus* sp., which attacks the foliage.

ITO (H.). **Studies on the Fumigation for the Eggs of** *Sturmia sericariae* **Cornalia. I. The Fumigation with various aromatic Hydrocarbons for the Eggs of** *Sturmia sericariae*.—*Res. Bull. Tokyo seric. Coll.* **1** no. 1 pp. 1–8, 8 refs. Tokyo, January 1936. **II. Naphthalene Fumigation for the Eggs of** *Sturmia sericariae*, **and the Effects of the fumigated Mulberry Leaves on the Silkworm.** —*T.c.*, pp. 9–25, 5 refs. (With Summaries in English.)

The following is taken from the summaries of these two papers :— Of a number of chemicals tested as fumigants against the eggs of *Sturmia sericariae*, Rond., in Japan, benzene killed all the eggs in 5

hours and naphthalene in 3 hours without injury to mulberry foliage ; xylene and toluene killed all the eggs in 1 hour, and thymol in 3 hours, but all three materials injured the foliage.

Under experimental conditions the eggs were killed in 3 hours by fumigation with naphthalene used at the rate of 0·005 gm. per litre of air space [0·5 oz. per 100 cu. ft.]. Naphthalene fumigation did not injure mulberry foliage or affect the development of larvae of the silkworm [*Bombyx mori*, L.], when fed on the fumigated leaves throughout the 5th instar, or egg production by the resulting moths. Naphthalene is not injurious to man, and the cost of fumigation is considerably less than that of other materials.

KANZAWA (T.). **Studies on *Drosophila suzukii* Mats.** [*In Japanese.*]—*J. Plant. Prot.* **23** nos. 1–3, pp. 66–70, 127–132, 183–191. Tokyo, January–March 1936.

Injury to cherry by *Drosophila suzukii*, Mats., all stages of which are described, was first observed in Yamanashi Prefecture, Honshu, in 1916. The adults hibernate from November to March and begin to oviposit in sound cherry fruits in May. Two or three generations occur on cherry until the end of June, 75–80 per cent. of the fruits being sometimes attacked, after which breeding continues on fruits of wild *Rubus*, as well as ripe or fallen peaches and plums, and later on, grapes and ripe persimmons. There appear to be about 15 generations a year, the shortest life-cycle lasting 8 days. The females begin to oviposit 1–4 days after emergence and lay 11–362 eggs, which hatch in 20–92 hours. The larvae mature in 4 days or more, and the pupal stage lasts 3–5 days. In an experiment in summer, the males lived 14–29 days and the females 20–48 when fed on cherry. The flies were attracted by molasses mixed with saké or wine. The eggs and larvae were killed by 4 days' exposure to temperatures just above freezing point.

BALCH (R. E.). **The European Spruce Sawfly Outbreak in 1935.**—*Canad. Ent.* **68** no. 2 pp. 23–31. Orillia, February 1936.

Diprion polytomus, Htg., occurs on spruce over the greater part of the forest region of eastern Canada and the north-eastern United States. If it originated from the Gaspe peninsula, Quebec, where the spruce is now largely defoliated over an area of about 6,000 sq. miles [*cf. R.A.E.*, A **23** 236], it must have considerable powers of dispersal. Periodic collections of adults showed that they fly at least 1½ miles and probably much more. They tend to fly more in calm, warm, sunny weather, and take to flight then shortly after emerging. In the centre of the Gaspe area the cocoon population remains high, although it was reduced in 1935 by the scarcity of foliage. The average number of sound cocoons in 50 plots 2 ft. square under black spruce [*Picea mariana*] was 52 in the autumn as compared with 70 in the spring. Of the 173 old or empty cocoons, adults had emerged from 51, 97 had been destroyed by small mammals, 14 by predacious insects, and in 11 the insect had died from other causes. On the average only 20 per cent. of the hibernating larvae in the Gaspe area emerge as adults in the spring. In the stands of white spruce [*P. glauca*], the population has been heavier, but has recently been more severely reduced by scarcity of foliage and by natural enemies. In a small

heavily-infested area to the west in Kamouraska county (Quebec) the scarcity of foliage has not been so great. About 98 per cent. of the larvae remained dormant in 1934, and the trees recovered much of their foliage. Predators reduced the number of cocoons by about 35 per cent. In 1935 the percentage emergence was about 20, infestation was heavy, and the number of cocoons, particularly beneath black spruce, increased. This increase under black spruce suggests that it may ultimately be as heavily attacked as white spruce. Tables show the average percentages of sound cocoons, those from which adults had emerged, and those destroyed by natural enemies and other causes in sample plots under black and white spruce in this area and in 2 areas in New Brunswick.

During the past 5 years the larval population on the trees in the Gaspe area has shown some annual fluctuation, largely because of variations in percentage of emergence, but in general has increased slowly. The larvae prefer the old foliage but the percentage of defoliation has gradually increased until at present the white spruce is almost completely defoliated and the black spruce is in almost as bad a condition. The adults are apparently spreading outwards from the centre of the area. The infestation has in general increased during the past 2 years in the lightly-infested areas in Quebec and New Brunswick, but defoliation has not yet become noticeable.

The sawfly appears to be well adapted to maintaining itself in destructive numbers throughout the range of spruce forests. The larvae can survive 16°F. in the Gaspe area although there is some mortality at temperatures several degrees higher. In Kamouraska county there is a small partial second generation, and in central New Brunswick there are two complete generations, and a few stray adults lay eggs of a third. Temperatures below 0°F. kill some of the hibernating larvae, and the percentage of mortality increases to 100 at about −18°F. In the forest, however, they are almost entirely protected by snow. Cocoons are only occasionally spun in the trees and are then either destroyed by birds or squirrels or by cold. The larvae can also withstand 100°F. and usually lie beneath the twigs in strong sunlight. Prolonged cold rains kill newly-hatched larvae but only cause older ones to stop feeding. Shrews and rodents do not destroy more than half the cocoons. The only insect predator of importance is *Podisus serieventris*, Uhl., which was rather abundant in New Brunswick in 1935. Of the many thousands of larvae and cocoons collected only 8 were parasitised, 3 by the Tachinid, *Ptychomyia* (*Bessa*) *selecta*, Mg., which attacks *Lygaeonematus erichsoni*, Htg. (larch sawfly). Reproduction is parthenogenetic and males are very rare. Larvae may remain dormant for 1–5 years. The insect has been reared through 10 generations in the laboratory at 70°F. and 80 per cent. relative humidity. Some larvae went into a diapause that could only be broken by cooling for a considerable length of time.

The effects of defoliation on the trees are briefly described; severe damage has been confined to areas where white spruce predominates. The sawfly develops slightly more rapidly and its size and reproductive potential are greater on white than on black or red spruce [*P. rubra*]. Black spruce, however, has been very heavily defoliated, particularly on the slopes, which generally lie above the floor of a valley covered with white spruce, and some of the trees are already dying. In 1935 about 45 per cent. of the white spruce in the Cascapedia river area had been killed by *Dendroctonus piceaperda*, Hopk., and about 8 per cent. were

dead from defoliation alone. Almost all the rest of the spruce was so seriously defoliated that it is improbable that it will recover. The amount of timber killed by the bark-beetle and sawfly probably exceeds 6 million cords (about 28½ million cu. yds.).

JACOT (A. P.). **Spruce Litter Reduction.**—*Canad. Ent.* **68** no. 2 p. 31. Orillia, February 1936.

Examination of spruce litter from North Carolina and Tennessee showed that needles that have been partly decomposed by fungi usually contain one or two Phthiracarid mites, which eat the contents, leaving only the walls. The adults cut their way out through the walls but can only oviposit in decomposed needles. All wingless species of animals that eat decayed leaves and oviposit in leaf litter would be destroyed by ground fires. In order to reduce the leaf litter in a stand that had been burned this fauna should be introduced from an unburned area.

HARRISON (A. L.). **Mosaic of the Refugee Bean.**—*Bull. N. Y. St. agric. Exp. Sta.* no. 656, 19 pp., 7 figs. Geneva, N.Y., October 1935. **The Physiology of Bean Mosaic.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* no. 235, 48 pp., 10 figs., 52 refs. **Transmission of Bean Mosaic.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* no. 236, 19 pp., 3 figs., 13 refs.

In the first of these papers an account is given of common bean mosaic, which apart from a few years preceding 1920, when it caused heavy loss to the bean crop in New York State, was not unusually severe there until 1928, since when losses have again been considerable on Refugee bean, a variety of *Phaseolus vulgaris* largely used for canning. The symptoms of the disease are described. It is confined almost exclusively to various species of bean, and is distinct from the yellow bean mosaic, caused by a virus that produces mosaic diseases in various other leguminous plants. It is a seed-borne disease, mainly transmitted in the field by various sucking insects.

In the second paper an account is given of an investigation of certain properties of the virus and of the effects of the disease.

The third paper describes experiments to discover which leguminous plants are the primary sources of the various mosaics occurring on bean, to determine the identity of the diseases, and discover how they are transmitted. Great difficulty was experienced in all attempts to transmit them from leguminous plants to the Refugee bean by the leaf mutilation method, but *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) often acted as a vector of common bean mosaic from beans and of a disease perhaps identical with the yellow mosaic of Pierce [*R.A.E.*, A **22** 219] from white sweet clover (*Melilotus alba*), red clover (*Trifolium pratense*), alsike clover (*T. hybridum*) and black medick (*Medicago lupulina*). It failed to transmit a mosaic from pea (*Pisum sativum*) or one from lucerne (*Medicago sativa*), but did transmit bean mosaic from a single plant of white sweet clover that had been raised from seed. Yellow bean mosaic is not seed transmitted. In general, therefore, the mosaics occurring in leguminous plants near Geneva, N.Y., are distinct from common bean mosaic, though it is possible that white sweet clover may occasionally be infected with it and that other plants may be

symptomless carriers. Insects by which other workers have found bean mosaic to be transmitted are enumerated [**11** 145 ; **21** 168 ; **22** 219]. The author's attempts with *Lygus pratensis*, L., *Empoasca fabae*, Harr., *Cerotoma trifurcata*, Forst., and three species of flea-beetles collected from mosaic-infected beans in the field have been unsuccessful.

Studies on seed transmission showed that seed free of bean mosaic can be obtained by autumn roguing in fields where some of the plants remain healthy until the blooming stage. Though the disease is not readily transmitted by contact of aerial parts of the plants, transmission resulted when infected and healthy leaves were brushed together by wind from an electric fan. Observations in 1932, 1933 and 1934 show that it does not spread so rapidly on exposed as on sheltered plots.

HASEMAN (L.) et al. **Entomology.**—*Bull. Missouri agric. Exp. Sta.* no. 358 (Rep. 1933–34) pp. 60–70, 2 figs. Columbia, Mo., December 1935.

The results of biological studies of the codling moth [*Cydia pomonella*, L.] in Missouri in 1934, when drought created a most unusual season, showed that there were practically 4 full broods, the complete life-cycle requiring less than 5 weeks. Excessive heat at midsummer practically stopped breeding of the first generation moths. Heavy breeding of late brood moths caused severe loss from late larvae, and a considerable population was carried over in the orchards. The addition of summer oil emulsion in the 3 most important lead arsenate sprays doubled the effectiveness of control but complicated spray residue removal. The results of an investigation into the effectiveness of substitutes for lead arsenate, which are given in tables, showed that zinc arsenate may be safely used to replace lead arsenate in the less important cover sprays. Lead arsenate still seems to be the most effective insecticide. As 1·9 per cent. of the hibernating larvae are found in objects on the ground, 89·4 per cent. on the trunk or under bands, 6·2 per cent. in crotches and on main branches, and 2·5 per cent. on limbs and twigs, careful scraping, banding and treating the crotches will account for about 95 per cent. of all hibernating larvae. Bands dipped in a cold solution of beta naphthol in oil thinned with petrol were as effective in killing the larvae as those dipped in a hot solution of beta naphthol in oil.

Although the outbreak of chinch bug [*Blissus leucopterus*, Say] was the worst throughout the Mississippi Valley for nearly 50 years, the excessive heat and drought reduced the second brood so that the number going into hibernation in Missouri was hardly as great as in 1933. Observations showed that careful close burning of clump grass affording shelter to the bugs in the autumn of 1933, although valuable in reducing their numbers, did not completely destroy them even when followed by snow, sleet and sub-zero temperatures. Refrigerator investigations showed, however, that low temperatures do kill the bugs, 100 per cent. dying when quickly frozen in ice. They are very resistant to drowning, 50 per cent. surviving 14 hours' submergence in water without air. Insecticides can be used economically against *B. leucopterus* only as line barriers or for killing the bugs on the first few rows of maize. Crude creosote and crude naphthalene were the best repellents for the barriers, and calcium cyanide flakes, sprinkled at right angles to the barrier line at intervals proved very effective in killing the nymphs that crawl along the oil line. A dust consisting of 1 oz. nicotine sulphate and 1 lb. lime killed the bugs on maize.

MARSHALL (J.) & GROVES (K.). **The present Status of Calcium Arsenate in Codling Moth Control.**—*Proc. Wash. St. hort. Ass.* **31** pp. 142–149, 3 refs. Pullman, Wash., December 1935. [Recd. March 1936.]

Sprays containing calcium arsenate, zinc sulphate and calcium hydrate (3 or 4 lb., 1 lb., and 2 lb. respectively in 100 U.S. gals. spray) give comparable results to lead arsenate (3 lb. in 100 U.S. gals) in control of light infestations of codling moth [*Cydia pomonella*, L.] on apple in Washington [*cf. R.A.E.*, A **24** 168]. Better control is obtained with early varieties or those not susceptible to attack by third brood larvae, against which calcium arsenate is less effective, probably because of the greater loss of the deposit in weathering and fruit growth. These sprays appear to stimulate the foliage. They do not control the two-spotted mite [*Tetranychus telarius*, L.], but are compatible with the so-called colloidal sulphur and may be used following sulphur sprays. Against moderate infestations, the addition of $\frac{1}{4}$ lb. zinc sulphate and $\frac{1}{2}$ lb. calcium hydrate to sprays containing 3–4 lb. calcium arsenate with $\frac{1}{2}$ per cent. mineral oil [*cf. loc. cit.*] eliminated injury, and the spray improved the appearance of the trees and gave better control than 3 lb. lead arsenate alone or with 1 U.S. pint herring oil. Experiments showed that an increase in the amounts of petroleum oil between $\frac{1}{4}$ and 1 per cent. gave greater arsenic deposits and greater control. At $\frac{1}{4}$ per cent. heavy oils (123 secs. viscosity) gave about 30 per cent. greater deposits and control than lighter ones (70 secs. viscosity). Combinations of oils of a low degree of refinement (57 per cent. unsulphonatable) with calcium arsenate caused considerable injury, which appeared to be arsenical. Preliminary tests indicate that triethanolamine oleate and petroleum oil could be used in combination with calcium arsenate as with lead arsenate [*cf.* A **23** 274] provided that a certain optimum quantity of zinc sulphate were added. Applied against the second brood larvae, this combination left a deposit of about 365 micrograms arsenic per sq. in. compared with about 140 on trees sprayed with lead arsenate and herring oil. Good control resulted, and no arsenical injury was observed, although the neighbouring plots sprayed with lead arsenate and herring oil were damaged.

NOZU (R.). **Results of Spraying Experiments with Derris Insecticides against** *Kakivoria flavofasciata* **Nagano.** [*In Japanese.*]—*J. Plant. Prot.* **23** no. 1 pp. 36–42. Tokyo, January 1936.

In experiments against the Tineid, *Kakivoria flavofasciata*, Nagano, on persimmon in Japan [*cf. R.A.E.*, A **12** 350], sprays of neoton (a derris insecticide), nicotine sulphate or lead arsenate and calcium caseinate were effective for control, neoton being the most successful.

MIZUSAWA (Y.) & FUJITA (K.). **Fundamental Studies for the Control of** *Ceroplastes rubens* **Mask.** [*In Japanese.*]—*J. Plant Prot.* **23** nos. 1–2 pp. 50–56, 98–106. Tokyo, January–February 1936.

Ceroplastes rubens, Mask., is very injurious to *Citrus* in Japan [*cf. R.A.E.*, A **24** 42]. The larvae swarm from the end of June to August, especially in July, and settle on the young shoots. Removal of the adults from the plant just before they begin to oviposit affected neither oviposition nor the duration of the egg stage.

YAGO (M.) & FURUKAWA (N.). **The Cicada in Pear Orchards.** [*In Japanese.*]—*Agric. & Hort.* **11** no. 1 reprint 13 pp., 11 figs. Tokyo, January 1936.

In recent years Cicadids have been injurious to pear in the Prefectures of Tokyo, Kanagawa and Shizuoka [*cf. R.A.E.*, A **23** 15], the most important being *Graptopsaltria colorata*, Stål. In Shizuoka Prefecture the adults of this species, which live for about 3–10 days, can be found on various fruit trees from early summer to early autumn. Hibernation occurs in the egg stage ; the eggs are laid in bark and dry wood and hatch in 307–322 days. The larvae feed on the roots of pear, fig, and *Citrus*. The fungus, *Massopora cicadina*, is parasitic on the adults.

OKADA (I.). **On** *Bolitophila disjuncta* **Loew and** *Bolitophilella cinerea* **Meig.** [*In Japanese.*]—*Kontyû* **10** pp. 28–35, 4 figs. Tokyo, February 1936.

The Mycetophilids, *Bolitophila disjuncta*, Lw. and *Bolitophilella cinerea*, Mg. [*cf. R.A.E.*, A **23** 677] have two generations a year in Hokkaido. Infestation of the edible fungus, *Armillaria mellea*, by *B. disjuncta* is sometimes as high as 50 per cent., but it very rarely attacks other fungi. *B. cinerea* feeds on a wide range of fungi, *Pholiota* spp. being preferred. Descriptions of all stages except the egg are given.

MORITOSHI (N.). **Digestive Fluids of phytophagous Insects and the Hatching of the Eggs of** *Sturmia sericariae*, **Corn.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 1 pp. 20–27. Tokyo, February 1936.

Sturmia sericariae, Rond., is parasitic in silkworms [*Bombyx mori*, L.] and other Lepidopterous larvae in Japan. The eggs, when ingested with food by the larvae, hatch in the digestive fluid ; they also hatch in 0·5 per cent. potassium hydroxide or other alkaline fluids. In experiments with many Lepidopterous larvae and sawflies, it was found that they hatch in the digestive fluids of Lepidoptera if the pH value is 9·8–8·8, the higher percentage hatching at the higher values, but not if it is below 8·6. The digestive fluid of silkworm, the pH of which averages 9·47, loses its ability to induce hatching of the eggs when heated to 100°C. for over 30 minutes, although the pH is scarcely changed. In the sawfly larvae, the pH is 5·3–7·4, and the eggs do not hatch.

YATOMI (K.). **On some Habits of the Hibernating Larvae of** *Chilo simplex*, **Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 1 pp. 38–43. Tokyo, February 1936.

The larvae of *Chilo simplex*, Butl., are positively phototropic soon after hatching, but become negative in 4 or 5 hours when not fed. The older larvae are positive to light even when kept in adsol desiccators for up to 5 weeks, and are also positive just before pupation. They pupate in the rice stalks and other crevices, those with holes measuring 4 mm. in diameter being preferred.

Onoe (T.) & Sato (S.). **On Kerosene with Pyrethrum Extract. (Preliminary Report.)** *In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 1 pp. 44–47. Tokyo, February 1936.

In Japan it is generally recommended that pyrethrum extract be prepared by soaking pyrethrum in kerosene for 12–24 hours. Experiments and analysis, using 3 and 6 per cent. pyrethrum in kerosene at 25°C. [77°F.], have shown that the amount of pyrethrins extracted in 6 hours is as large as in 12–24. About 20 per cent. of the pyrethrins remain in the residue.

Nawa (U.). **On** *Theophila mandarina,* **Moore.** [*In Japanese.*]—*Insect World* **40** no. 3 pp. 80–83. Gifu, March 1936.

In Japan, *Bombyx* (*Theophila*) *mandarina,* Moore, which feeds only on mulberry, usually has three generations a year, passing the winter in the egg stage. The moths emerge in June, August and late October. A female lays about 250 eggs in masses on the branches. The young larvae feed during the daytime, and the older ones at night. All stages are described.

Tanimura (A.) & Sonan (J.). **Relation of Spraying Insecticides to Tea Plants and Tea Manufacture. I.** [*In Japanese.*]—*Bull. Govt Res. Inst. Formosa* no. 114, 55 pp. Taihoku, December 1935.

Soap solution (6 lb. soap in 100 gals. water), pyrethrum soap solution (2 lb. soap, 1–2 lb. pyrethrum and 40 gals. water) and weak lime-sulphur did not affect the quality of tea manufactured from the leaves harvested 11–13 days after spraying when there had been rain. Nicotine sulphate, however, affected the tea manufactured from leaves harvested 11–20 days after spraying. None of these sprays injured the tea plants.

Sonan (J.). **Psychidae of Formosa.**—*Trans. nat. hist. Soc. Formosa* **25** no. 147 pp. 448–455, 9 figs. Taihoku, December 1935.

The Psychids recorded include: *Mahasena oolona,* sp. n., and *Acanthopsyche* (*Eumetisa*) *taiwana,* subgen. et sp. n., on tea, and *A. saccharivora,* sp. n., on sugar-cane, the males of which are described; *Clania* (*Mahasena*) *minuscula,* Butl., on tea; and *C. pryeri,* Leech, on tea, *Citrus, Acacia,* camphor [*Cinnamomum camphora*], guava, cotton and many other plants. *C.* (*Cryptothelea*) *formosicola,* Strand, is considered a synonym of *C. pryeri.*

Takahashi (R.). **Two interesting Scale Insects attacking the Lauraceae in Formosa (Hemiptera).**—*Trans. nat. Hist. Soc. Formosa* **26** no. 149 pp. 80–83, 4 figs. Taihoku, February 1936.

Aulacaspis phoebicola, sp. n., is described from *Phoebe formosana,* and *Gymnaspis cinnamomi,* sp. n., from *Cinnamomum* sp. A list is given of the other Coccids attacking Lauraceae, including *Cinnamomum,* in Formosa.

Kondo (T.) & Miyahara (H.). **Studies on** *Adoxophyes congruana,* **Wlk.** [*In Japanese.*]—*Rep. Kantocho agric. Exp. Sta.* no. 2 pp. 1–43, 3 pls. Kinshu, Manchuria, December 1935.

Adoxophyes congruana, Wlk., all stages of which are described, causes serious damage to apple and other pomaceous fruits in Manchuria, sometimes injuring 80–90 per cent. of the apple crop. It has

3 generations a year, the adults emerging in June, July–August and August–September. The larvae hibernate in sheltered places on the tree, usually in the second instar, and begin to be active in mid-May. They spin the young leaves together in spring and attack the fruits later. In summer the larval stage lasts 25–31 days. In captivity, the adults lived 4–10 days, and females laid 27–231 eggs in 1–3 masses. The egg stage lasted 6–10 days, and the pupal 5–9.

Lead arsenate sprays prevent injury to the leaves, but do not entirely protect the fruits. Spraying with nicotine sulphate is effective against the hibernating larvae.

Woo (F. C.). **Survey of the Distribution and Prevalence of Cotton Insects in China during the Year 1934.**—*Spec. Publ. nat. agric. Res. Bur. China* no. 12, 34 pp., 4 maps. Nanking, Minist. Ind., September 1935. Price $0·50. (With a Summary in English.) [Recd. March 1936.]

This report, which is based mainly on data obtained in 7 provinces, includes a list of 18 cotton pests that were injurious in 1934. In October 15·1 per cent. of the seed in Nanking was injured by *Platyedra* (*Pectinophora*) *gossypiella*, Saund., which is one of the most serious pests of cotton in China, occurring practically wherever the crop is grown. It injured 6·1, 7 and 7·6 per cent. of the squares in Hunan, Hupeh and Chekiang, respectively, in September. In each pound of seed cotton there were about 80 larvae at Nanking and about 290 in Kiangsu. *Earias cupreoviridis*, Wlk., is not so widely distributed and is not found much further north than Shantung ; it was not taken in Hopei in 1934. Along the coast of northern Kiangsu, however, it is the most serious pest of cotton, and in August in one locality it caused 70 per cent. of the squares and bolls to drop. *Heliothis armigera*, Hb. (*obsoleta*, F.), which has never before been reported as a serious cotton pest in China, caused widespread injury, especially in Kiangsu and Chekiang. From 11·5 to 78·7 per cent. of the squares and bolls examined in Kiangsu during October and 90 per cent. of those at Hangchow in July were injured. *Aphis gossypii*, Glov., caused serious damage in Kiangsu, Hunan, Hupeh and Yunnan. *Agrotis ypsilon*, Hfn., *Euxoa segetum*, Schiff. (*A. segetis*, Hb.), and an unidentified cutworm were present in Nanking. Cutworms injured 50–60 per cent. of seedling cotton in Kiangsu and 20–40 per cent. in Chekiang. The Noctuid, *Cosmophila* (*Anomis*) *flava*, F., destroyed 90 per cent. of the cotton leaves in northern Kiangsu. *Tetranychus telarius*, L., injured 92 per cent. in Hunan. With some cotton insects the degree of injury varies according to the variety of the plant ; *Sylepta derogata*, F., and *A. gossypii* are always more injurious to American than to Chinese cotton. Maps show the distribution of the chief pests in 1934.

Ho (W. T. H.) & Li (L. Y.). **Preliminary Notes on the Virus Diseases of some economic Plants in Kwantung Province.**—*Lingnan Sci. J.* **15** no. 1 pp. 67–78, 5 figs., 29 refs. Canton, January 1936.

Data collected mostly from field observations are recorded on virus diseases of 13 economic plants in the Kwangtung Province of China. Those in respect of which mention is made of possible insect vectors are a mosaic-like disease of tomatos and mosaic of sugar-cane.

Hoffmann (W. E.). **The Bionomics of the Rose Sawfly, *Arge victorina* Kirby (Hymenoptera : Argidae), with Notes on other injurious Tenthredinoid Larvae in Kwangtung.**—*Lingnan Sci. J.* **15** no. 1 pp. 101–112, 1 pl., 2 refs. Canton, January 1936.

Arge victorina, Kirby, is a serious pest of roses in the Canton area, where the petals are used for scenting tea, etc. The eggs, larvae and adults are described. The eggs are inserted into a stem in two longitudinal rows. One female was seen to deposit 43 eggs in 3 separate slits, the first being the largest and containing 22. During the incubation period, which lasts about a week in the middle of May, the oviposition slit spreads and becomes darker and more noticeable, and the eggs become visible. The larvae begin feeding on the margin of the leaf soon after hatching ; they are gregarious in the early instars and less so later on. They enter the soil to pupate and probably hibernate there. Larvae hatching early in May spent 4–5 days in the first instar, a little over 24 hours in each of the next two, 1–2 days in the fourth and 2 days in the last. The pre-pupal and pupal stages lasted 4–5 days each, and the adults remained a further 2 days in the cocoon before emerging. The pre-oviposition period lasted 3–5 days. Adults, probably of the overwintered generation, were seen in the field on 14th April. Both larvae and adults are numerous in May and June and again in October. Where the number of infested bushes is small, hand-picking and the application of Flit give practical control, and even spraying with water, if applied with sufficient force, is effective. Where roses are planted in some numbers, spraying with lead arsenate (1 lb. to 50 gals. water) gives satisfactory results. The constant removal of débris from beneath bushes will hinder pupation and frequent working of the soil destroys pupae in the ground.

Sand pears are seriously injured in the Canton area by a species of *Arge* near *fuscipes*, Fall., the trees being completely defoliated and the crop ruined in some years. The larva and adult are described. There are several generations each season, the first of which is completed by the first week in May. Insecticides recommended include lead arsenate as a spray or dust, soap (1 lb. to 4 gals. water), or hellebore as a spray (1 oz. to 1 gal. water) or as a dust mixed with 5–10 parts of flour.

Ten other species of sawflies, none of which have been identified, are recorded as occurring on different plants in the Canton area, and the larvae of eight of them are briefly described.

Hoffmann (W. E.). *Diaphorina citri* **Kuw. (Homoptera : Chermidae), a *Citrus* Pest in Kwangtung.**—*Lingnan Sci. J.* **15** no. 1 pp. 127–132, 2 figs., 5 refs. Canton, January 1936.

Recent observations have shown that *Diaphorina* (*Euphalerus*) *citri*, Kuw., is of some importance as a pest of *Citrus* in Kwantung. Adults were found feeding on 27th November 1934 on several species of *Citrus* and on *Clausena lansium*. No examples of this Psyllid were found during December 1934 and January 1935, but nymphs and adults were observed on *Citrus* seedlings or trees at various dates in each month from late February until June. In one instance a nymph had been seized by a red mite. Nymphs of all instars were again found on 25th September, but there was no sign of either nymphs or adults when final observations were made at the end of the year. Eggs collected on 29th June hatched on 1st July, and the nymphs completed their

development in about 2 weeks. The nymphs are described. Data on the bionomics and control of *D. citri* in India and elsewhere are briefly reviewed [*cf. R.A.E.*, A **16** 187, etc.]

CHEO (Ming-tsang). **A preliminary List of the Insects and Arachnids injurious to economic Plants in China.**—*Peking nat. Hist. Bull.* **10** pt. 3 pp. 167–182. Peiping, March 1936.

This list, which is a continuation of previous ones [*R.A.E.*, A **23** 721 ; **24** 203], comprises 133 Lepidoptera and shows the plants they attack and their distribution in China.

TAKAHASHI (R.). **Some Coccidae from China (Hemiptera).**—*Peking nat. Hist. Bull.* **10** pt. 3 pp. 217–222, 2 figs. Peiping, March 1936.

The Coccids recorded include 2 new species and 1 new variety. *Chionaspis stanotophri*, Cooley, which in the Far East had previously only been known in Formosa, was taken on sugar-cane in Hongkong in 1926.

TSENG (Shen) & TAO (Chia-chu). **Observations on Cotton-aphids, *Aphis gossypii* Glover, in the Vicinity of Tsinan.**—*Peking nat. Hist. Bull.* **10** pt. 3 pp. 233–252, 1 pl., 22 refs. Peiping, March 1936.

In June 1934 *Aphis gossypii*, Glov., which is the only serious pest of cotton in Shantung, reduced the average number of bolls from over 10 on healthy plants to 3 on infested ones, 26·53 per cent. of the plants producing no bolls at all. The loss in yield from 50 infested plants was 71·86 per cent. The time of opening of the bolls was delayed on slightly infested plants. Tests showed that Aphid injury lowers the strength and twist of the fibres, and that the spinning quality of the cotton is somewhat deteriorated.

Descriptions are given of the adults of all forms of this Aphid and of the eggs and the nymphs of the wingless and winged parthenogenetic females. The winged viviparous Aphids can produce a total of 2–26 young or 1–10 in one day, and the wingless ones a total of 6–45 or 1–8 in one day. The reproductive period averages 2·75 and 10·6 days for the winged and wingless forms, respectively. Reinhard's observations [*R.A.E.*, A **15** 533] on the production of winged forms were confirmed, in that they appeared when the Aphids were crowded or when the food-plant did not provide suitable nourishment. After July winged individuals appeared and migrated to wild grasses or to the newly-developed leaves at the base of the main stem of the cotton plant. The wingless viviparous Aphids mature in 4–7 days. During October and November, the winged sexuparae or last generation of the alienicolae fly to primary food-plants and produce wingless oviparae and winged males. After pairing the sexual females deposit eggs on the same or the next day. Oviposition continues for 1–8 days, during which 1–7 eggs are laid. In the field the Aphids overwinter in the egg stage, but in a greenhouse at about 65°F. they continued to reproduce parthenogenetically and passed the winter as winged or wingless parthenogenetic individuals on cucumber plants. Others attacking chrysanthemums produced sexual forms, and pairing and oviposition took place until the end of December or 1 month later than

on cotton in the field. A list is given of 43 species of plants on which *A. gossypii* has been found in the vicinity of Tsinan. The primary food-plants include *Marubium supinum*, *Chrysanthemum sinense* and *Plantago major* var. *asiatica*.

Predators attacking *A. gossypii* were the Syrphids, *Paragus quadrifasciatus*, Mg., *Syrphus balteatus*, DeG., *Sphaerophoria menthastri*, L., and *Xanthogramma* (*Ischiodon*) *scutellare*, F., an unidentified Oscinid, the Coccinellids, *Coccinella septempunctata*, L., *C.* (*Ptychanatis*) *axiridis*, Pall., *Propylea japonica*, Thnb., *Hippodamia tredecimpunctata*, L., and *Hyperaspis reppensis*, Hbst., *Chrysopa japana*, Okamoto, *C. septempunctata cognata*, McLach., and an unidentified Reduviid. A Braconid of the genus *Aphidius* attacks the Aphids as soon as they appear on the cotton leaves. During May and June the parasitism averages 10·95 per cent. Coccinellids and Chrysopids occasionally prey upon Aphids already parasitised by *Aphidius* and the latter is itself parasitised by *Aphidencyrtus* sp. The pupae of *S. menthastri* and *X. scutellare* are parasitised by *Pachyneuron* sp., and the Oscinid by *Euryischia* sp. The egg, larval and pupal stages of the Chrysopids occupy about 4, 8–10 and 14 days respectively. *C. septempunctata cognata* pupates on the leaves, and *C. japana* in the soil. The lengths of all the stages of *Coccinella septempunctata*, *C. axiridis* and *Propylea japonica* are tabulated. There are 3–4 generations a year. In cotton fields *A. gossypii* is often attended by the ants, *Lasius niger*, L., *Monomorium nipponense*, Wheeler, and *Formica fusca japonica*, Motsch.

Two sprays proved very effective against the Aphids, giving 98 per cent. control. The first consisted of 10 lb. tobacco, 1 lb. pyrethrum powder and 2 lb. soap in 100 gals. water, and the second of a stock emulsion of 90 lb. cotton-seed oil and 23–34 lb. soda (Na_2CO_3 and NaOH) in 4½–5 gals. water, diluted for spraying at the rate of 1 : 15–20. To prepare the first spray, the tobacco and soap are each boiled separately in some of the water (the tobacco for 90 minutes) and the pyrethrum powder is boiled for 5 minutes in the soap solution.

Gonzales (S. S.). **Progress Report on a Study of the Relation of Weather Conditions to the Development and Abundance of the Coconut Leaf Miner and its Parasites.**—*Philipp. J. Agric.* **6** no. 4 pp. 365–386, 6 charts. Manila, 1935. [Recd. March 1936.]

Investigations were carried out in the Philippines during 1933 and 1934 on the effect of weather conditions on the abundance of the coconut leaf-miner [*Promecotheca cumingi*, Baly] and its indigenous parasites.

Parasites were liberated in 2 out of 4 groves in each of 7 districts round S. Pablo, Laguna, which were representative of the different percentage infestations. The other 2 groves remained as controls. The groves selected were as far as possible from one another, and parasites were liberated in the two that were farthest apart. Each grove consisted of 500 trees, and on one day every week 50 leaflets were cut at random from each of 10 trees, to be examined. No other form of control was practised in any of the groves. The egg parasites, which were liberated on 1st April 1933, were *Centrodora* sp. and *Achrysocharis promecothecae*, Ferrière. On 6th May 1933 three larval parasites were liberated, including *Pleurotropis* sp., the most common, and *Sympiesis* sp., the only one of which the complete life-history was known. At

first there was some difference in the infestation in experimental and control groves, but later the control groves showed a high percentage of parasitism and the distribution was at times almost uniform. Even in strictly isolated groves the parasites were present after the first generation. The parasites thus seemed able to follow the host without human aid. Infestation decreased in the experimental area at the end of the period of study. From 21st April 1933 to 11th May 1934, 5 overlapping broods of the leaf-miner occurred, the life-cycle requiring 63–90 days. The duration of these broods varied inversely with the temperature and directly with the humidity.

A series of charts shows how the abundance of all stages of the parasites may be correlated with the elements of weather. For each generation the parasitism of the eggs was inversely proportional to the average temperature. There was a slight correlation between the abundance of the egg parasites and the relative humidity. High temperatures and low humidity dry up the eggs of the host and the moisture on which the adult parasites feed, and they increase the difficulty of oviposition in the host egg. Rain appears to reduce the number of egg parasites. The differences in the number of parasitised eggs between the treated and control groves during the first 4 broods were 3·64, 1·70, 0·40 and 2·23 per cent. respectively, and in the 5th brood parasitism was greater by 0·83 per cent. in the control groves. These data show the tendency of the parasites to disperse. *Pleurotropis* sp. should not be liberated against first-instar larvae, since although it sometimes succeeded in parasitising them, none of the progeny reached the adult stage. Several parasites are probably present in each larva but appear to have insufficient food. In all instars the number of larvae of the leaf-miner to the frond varied directly with temperature, and when the temperature was lower larval parasitism was higher. Great humidity and high precipitation appeared to result in high mortality of the larvae, particularly the young ones which seemed more susceptible to bad weather. Whereas the pupae of the leaf-miner are favoured by low temperatures, low precipitation and high humidity, its parasites are favoured by higher temperatures and low humidity. The average percentage of adult leaf-miners found dead inside blotches was greater in broods during which the average temperature was high. Adults were observed to be exhausted in the heat and to fly in the early morning when it was cool.

The duration of the broods can be predicted from the weather, and control can thus be adjusted.

Palo (M. A.) & Garcia (C. E.). **Further Studies on the Control of Leafhoppers and Tip-borers on Mango Inflorescence.**—*Philipp. J. Agric.* **6** no. 4 pp. 425–464, 7 pls., 28 refs. Manila, 1935. [Recd. March 1936.]

Chlumetia transversa, Wlk., is a serious pest of mango in the Philippines [*cf. R.A.E.*, A **20** 473]. It is most destructive to the off-season shoots and flowers occurring from October to January. Where flowering is continuous from October to April, 4 overlapping generations may occur. During the 3–4 months when no shoots or flowers are produced, the insect probably aestivates on some plant as yet unknown. In experiments, the egg, larval and pupal stages lasted 3–7, 8–12 and 8–17 days, respectively. The eggs are laid singly on the young panicles or shoots, and pupation occurs in the soil. The larvae

are parasitised by a Braconid of the genus *Chelonus*. Larvae can be killed by a stomach poison when newly hatched and feeding on tender tissue before entering the shoots, or when they come out of one panicle to enter another. A 0·5 per cent. lead arsenate spray applied 3 times at 3–4 day intervals during November or December, beginning when the panicles were 2–6 cm. long, reduced the infestation from 25–42 per cent. to 1·53–4·76. The spray appeared to be toxic to the open flowers. Spraying against *C. transversa* is of no practical value unless leafhoppers are also controlled. Clean cultivation, including the collection and destruction of infested flowers and shoots and the elimination of unnecessary trees and undergrowth, is also recommended.

The leafhoppers, *Idiocerus niveosparsus*, Leth., and *I. clypealis*, Leth., may be killed by spraying at 3 day intervals with 0·4 or 0·5 per cent. soap solution [**24** 121]. The trees should be thoroughly drenched. Experimentally only 2 out of 7 series sprayed 5 times made a monetary profit, owing to various causes including heavy shedding of the fruit and severe attack on the sprayed flowers and fruit by beetles. In some cases the soap solution damaged the flowers, and in severe infestations newly hatched nymphs injured them between consecutive sprays. Such sprays should therefore be used with caution, and tested on open blooms before use on a large scale. Better results would probably be obtained by the use of a dust when the trees are not in flower but the adults are abundant.

Both *Idiocerus* spp. and adults of *Chlumetia* were caught in light traps [*cf.* **21** 551], but not in very large numbers. However, such traps would reduce infestation if set during the flowering period. Their attraction is favoured by dark windless nights and a mean humidity of about 90 per cent.

MOULTON (D.). **A new Thrips on Cotton.**—*Philipp. J. Agric.* **6** no. 4 pp. 475–477. Manila, 1935. [Recd. March 1936.]

Descriptions are given of both sexes of *Bussothrips claratibia*, gen. et sp. n. (subfamily HELIOTHRIPINAE), taken on cotton in Manila during 1934.

OTANES (F. Q.). **The Identity of the Cotton Stem Weevil and Parasites of the Caterpillar of *Cosmophila* and the Common Mealy Bug.**—*Philipp. J. Agric.* **6** no. 4 pp. 503–504. Manila, 1935. [Recd. March 1936.]

Some of the unidentified insects mentioned in a recent report on cotton pests in the Philippines [*R.A.E.*, A **23** 708] have now been determined. The parasite of *Cosmophila* is *Euplectrus manilae*, Ashm., and the parasites of *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., are *Leptomastix longipennis*, Merc., *Holanusomyia pulchripennis*, Gir., and *Blepyrus insularis*, Ashm. The cotton stem weevil stated to be similar to *Phylaitis* sp., is *Pempheres affinis*, Fst., which also attacks cotton in southern India [*cf.* **22** 517].

L[EVER] (R. J. A. W.). **Some Insect Pests of local Economic Plants.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 4 pp. 3–5, 3 refs. Tulagi, October 1935. [Recd. March 1936.]

Insect pests occurring on economic plants other than coconut in the Solomon Islands are recorded, and suggestions given for their control.

They include : *Nacoleia* (*Lamprosema*) *octasema*, Meyr. (parasitised by *Apanteles* sp.) on banana ; *N.* (*Hedylepta*) *diemenalis*, Gn., on beans and *Centrosema pubescens* ; *Psara* (*Acharana*) *hipponalis*, Wlk., on beans and tobacco ; *Tirathaba rufivena*, Wlk., which has been found on the inflorescence of the betel nut palm, *Areca* [*catechu*] in Guadalcanal Island and on the male flowers of *Nipa* [*fruticans*], where it was parasitised by *Apanteles tirathabae*, Wlkn. ; the Coreid, *Amblypelta gallegonis*, Lever (MS), on cassava and croton (*Codiaeum*) on Isabel Island ; *Prontaspis* (*Chionaspis*) *citri*, Comst., on *Citrus* ; *Prodenia litura*, F., on the so-called Japanese clover (*Desmodium tortuosum*) and taro [*Colocasia*], the larvae being parasitised by *Sturmia inconspicuoides*, Baranov ; *Rhynchophorus schach*, Ol., found inside the stems of the ivory nut palm [*Coelococcus salomonensis*], though it cannot infest them unless the surface of the trunk is injured ; *Dysdercus cingulatus*, F., and *Lygaeus familiaris*, F., on kapok ; *Ceratia* (*Aulacophora*) *similis*, Ol., and *Monolepta semiviolacea*, Fauvel, on pumpkins ; *Oxya gavisa*, Wlk., attacking rice on San Cristobal ; *Cylas formicarius*, F., on sweet potato ; and *Hippotion celerio*, L., on taro.

LEVER (R. J. A. W.). **Insects of the Coconut Palm in the British Solomon Islands. List 4.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 4 pp. 6–7. Tulagi, October 1935. [Recd. March 1936.]

In this fourth list [*cf. R.A.E.*, A **23** 203], which is the final one, the number of identified insects recorded on coconut in the Solomon Islands is brought up to 95. The insects considered to be pests are *Graeffea rosea*, Stoll, and *Megacrania phelaus*, Westw., on the leaves ; *Brizica alacris*, Wlk., on the nuts and male flowers ; and *Rhynchophorus schach*, Ol. [*cf.* preceding paper and **23** 280]. Of the insects previously recorded on coconut, *Phenacoccus horridus*, Green [**21** 360] is stated to be synonymous with *Heterococcus painei*, Laing [**18** 425].

LEVER (R. J. A. W.). **The Green Coconut Bug** (*Amblypelta cocophaga* **China**) **and induced immature Nutfall in the Coconut.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 4 pp. 9–10. Tulagi, October 1935. [Recd. March 1936.]

Experiments show that *Amblypelta cocophaga*, China, which occurs on coconut in the Solomon Islands [*cf. R.A.E.*, A **22** 490 ; **23** 634], causes the immature nuts to fall. On each of 2 adjoining estates 20 coconut palms were caged and 25 intervening palms were left uncaged. Nuts were set on 85 per cent. of the caged and on 50 per cent. of the uncaged palms. Of those that had no nuts 15 per cent. of the caged and 50 per cent. of the uncaged palms were barren. Up to 7 nymphs and adults of *Amblypelta* were placed on each of a series of caged palms. About 90 per cent. of the nuts fell off these trees as compared with about 70 per cent. off an equal number of caged control trees. *Amblypelta* thus caused 66 per cent. of the nuts that normally would remain to fall. This Coreid is found on a variety of jungle plants.

Axiagastus cambelli, Dist., may also possibly induce some fall of the nuts from coconut.

L[EVER] (R. J. A. W.). *Brontispa* **Leaf-beetles and their Parasite *Tetrastichodes* in the Austro-Malayan Region.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 4 pp. 10–11, 1 map, 8 refs. Tulagi, October 1935. [Recd. March 1936.]

The distribution of the species of *Brontispa* that attack coconut in the Malayo-Melanesian Region is outlined, and reference is made to the introduction of the Eulophid, *Tetrastichodes brontispae*, Ferrière, from Java, where it parasitises *B. longissima*, Gestro, into Celebes, where it has proved of value in the control of *B. froggatti* var. *selebensis*, Gestro [*R.A.E.*, A **23** 509]. It is proposed to introduce this Eulophid into the Solomon Islands against *B. froggatti*, Sharp, and an experimental batch of 20 parasitised pupae was sent from Celebes *via* Sydney to the Solomons in August 1935, but the adult parasites were dead within the host pupae when these were dissected after arrival.

VEITCH (R.). **Red Shouldered Leaf Beetle.**—*Qd agric. J.* **45** pt. 2 pp. 128–130, 3 figs., Brisbane, 1st February 1936.

The Galerucid, *Monolepta rosea*, Blkb., attacks many plants in Queensland [*cf. R.A.E.*, A **11** 279], including cotton and a wide range of fruit trees. It is normally a minor pest but occasionally appears in enormous numbers and destroys the leaves, fruit and flowers in a few days. The duration of such an infestation is usually brief. It may be controlled by means of flares [*cf.* **11** 339] or by applying lead arsenate as a spray or a dust. If, however, lead arsenate is used when many beetles are present, much damage may be done before they eat a lethal dose.

COTTIER (W.). **The Use of Insecticides in the Control of the White Butterfly.**—*N.Z.J. Agric.* **52** no. 1 pp. 24–29, 2 figs. Wellington [N.Z.], 20th January 1936.

Although in New Zealand the white butterfly [*Pieris rapae*, L.] will probably be controlled in general by imported parasites [*cf. R.A.E.*, A **23** 724], it is likely that insecticides will be necessary in special areas. Various dusts and sprays were therefore tested on experimental plots, each consisting of 2 adjoining rows of 30 cabbages separated from the next by 1 control row. The insecticides were applied 3 times, in early January and February, and in mid-February. Dusting was carried out in the early morning and spraying during the day. In late February and March the larvae on each row were counted. All sprays were applied at the rate of 240 gals. per acre unless otherwise stated. Sprays of lead arsenate (2, 3 or 4 lb. lead arsenate with ½ lb. commercial spreader or 6 lb. soft soap to 100 gals. water) and calcium arsenate (at the same concentration) both gave excellent control, as did derris dusts (0·5–0·75 per cent. rotenone content) applied at the rate of 11–28 lb. per acre, and derris sprays with summer oil (1 lb. derris and 0·2 gals. summer oil to 20 gals. water) at the rate of 180–240 gals. per acre. An atomised kerosene extract of fresh pyrethrum flowers at the rate of 100–300 cc. per 60 cabbages gave good results. It was prepared by steeping 1 lb. coarsely powdered flowers in 1 gal. specially refined kerosene and filtering after 24 hours. An ordinary pyrethrum spray was rather less effective. Dusts of lead or calcium arsenate and lime were less effective than sprays of the same substances, even when the same amount of arsenate was applied. Barium fluosilicate and nicotine sulphate sprays and dusts, pyrethrum dusts, summer oil sprays

and salt solution all gave poor results. The barium fluosilicate sprays (of the same concentration as the lead arsenate) scorched the foliage, and 4 per cent. salt solution stunted the growth.

Tests were made of the arsenical residue left on cabbages after 3 sprays containing 2, 3 or 4 lb. lead arsenate to 100 gals. The residue ranged from 0·0001 to 0·0005 grains arsenic (As_2O_3) per lb. for cabbages with the outer leaves removed when the interval between the last spray and the harvest was 5 weeks, and from 0·013 to 0·231 grains arsenic per lb. for the complete cabbage when the interval was $6\frac{1}{2}$ weeks. Derris dusts and sprays are therefore recommended, although slightly more expensive than arsenicals ; they can be used right up to harvest. The derris should contain 0·5–0·75 per cent. rotenone, and should be applied at the rate of 20–25 lb. per acre.

WILLE (J.). **Viaje de estudio a Huánuco y Chanchamayo. La** *Icerya purchasi,* **queresa blanca de los árboles cítricos y su combate por el escarabajo coccinellido** *Novius cardinalis.* [A journey to Huánuco and Chanchamayo. *I. purchasi,* the white Scale of *Citrus* and its Control by *Rodolia cardinalis.*]—*Inf. Direcc. Agric. Ganad. Peru* no. 32, 23 pp., 9 figs. Lima, November 1935. [Recd. March 1936.]

Various pests were observed in the valley of Chanchamayo and in the district of Huánaco, Peru, in September 1935. Those in Chanchamayo included *Diatraea saccharalis,* F., which was much less abundant than on the coast, occurring in not more than 15 per cent. of the sugar-cane stems, and was parasitised by *Ipobracon rimac,* Wolcott, and *Paratheresia claripalpis,* Wulp. Old, over-ripe canes were severely infested by *Metamasius hemipterus,* L., and *M. anceps,* Gyll., and both these weevils also attacked banana stems. *Lepidosaphes beckii,* Newm., *Selenaspidus articulatus,* Morg., and *Coccus* (*Lecanium*) *hesperidum,* L., were abundant on *Citrus,* though their numbers were sometimes reduced by Coccinellids. The Pyralid, *Stenoma catenifer,* Wlsm., infested the fruits of avocado. A leaf-cutting ant, *Acromyrmex* (*Atta*) *hispidus,* Santschi, was a general pest.

In the Huánaco district *Anastrepha fraterculus,* Wied., attacks various fruits. *Icerya purchasi,* Mask., which is the most important pest of *Citrus,* and its control by *Rodolia* (*Novius*) *cardinalis,* Muls., are dealt with in both papers. *Icerya* was introduced into Huánaco in 1929 on mandarin oranges from Italy and has spread there from *Citrus* to *Spartium junceum. R. cardinalis,* which was introduced from Lousiania in 1932, controls it when outbreaks occur from time to time on *Citrus* and also attacks it on *S. junceum,* but less readily, so that this plant serves as a reservoir for both insects [*cf. R.A.E.,* A **21** 177]. *Rodolia* has also proved effective against *Icerya* in other parts of Peru. In the second paper it is also stated that *Polistes canadensis,* L. (*infuscatus,* Lep.) has been observed to distribute *Icerya.*

SPENCER (H.), BROWN (L.) & PHILLIPS (A. M.). **New Equipment for obtaining Host Material for the Mass Production of** *Trichogramma minutum,* **an Egg Parasite of various Insect Pests.**—*Circ. U.S. Dep. Agric.* no. 376, 17 pp., 10 figs. Washington, D.C., December 1935.

The method used in Georgia in 1931–32 for the production of eggs of *Sitotroga cerealella,* Ol., to serve as hosts for *Trichogramma minutum,*

Riley, was to rear the moths in trays of maize stacked in incubators kept at a temperature of 80°F. and was essentially the same as that employed by Wishart [*R.A.E.*, A **17** 455]. The cost was £7 per million eggs in 1931 and £6 10*s.* in 1932 when about 25½ million and 31 million eggs, respectively, were bred. This method had certain disadvantages. Much maize was wasted as the moths only bred in grains near the upper and lower surfaces of the trays, inadequate ventilation caused heating of the grains which in some instances destroyed *Sitotroga*, and the incubators became quickly infested with Gamasid mites, weevils, and the parasite, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.). The latter could not be kept out even by the most careful screening with 60-mesh screen wire, and once it was present, it almost eliminated *Sitotroga*.

In 1932 a rearing cabinet of improved design was constructed. It consisted of a wooden frame 29½ × 28 × 24 inches, the top, bottom and back of which were covered on the inside with galvanised sheet iron, and also the full-length door in front, and the sides with 60-mesh copper screen wire. Large tinned-metal funnels were soldered in an inverted position over four 6½-inch holes in the metal top. Four automatic cylindrical collecting cans with tops of 60-mesh screen were screwed by their bottom ends on to funnels and inverted over the funnels on the cabinet. Sixteen narrow trays, 26 × ½ × 13½ inches were hung vertically inside the cabinet from a strip of wood on each side. Each side of the frame of each tray was covered with 12-mesh enamelled screen wire except for a narrow slot left open at the top through which the grain was introduced. In the autumn and winter of 1932–33 and the following spring 16 cabinets were used and a routine procedure for starting infestation was adopted. Seed wheat was fumigated with carbon bisulphide in airtight cans and stored in them until needed. For each cabinet about 1½ bushels of this grain were soaked for 10 minutes in cold water and then placed in the trays. The latter were then hung on a rack and immersed for 3 minutes in water heated to 158°F., drained and then dried in an incubator room free from moths for 3 days or until just dry enough to prevent the wheat from becoming mouldy when placed in the cabinet. *Sitotroga* eggs were fastened with photographic paste to cardboard disks of diameter 3¼ ins., about 50,000 to a disk. To start the infestation 1,200,000 of these eggs were placed in 8 of the vertical trays through the open slots on top of the grain and the trays placed in the cabinet. Two weeks later an equal number of eggs were placed in the other 8 trays. In this way marked peaks of emergence for the adult moths were avoided and almost uniform daily production was obtained. The cards of eggs were dipped momentarily in liquid carbon bisulphide to eliminate pests and then dried quickly. This treatment does not affect the eggs. After 35 days in the incubator at 80°F., the moths were removed by using the collecting cans. The cabinets could be continued in full production for 2 or 3 months. For a continuous production of 1 million eggs a day it was necessary to start 1 cabinet each week, the first being ready for restocking the week after the 16th was started. In 1933 with 16 cabinets a total of 125,110,000 eggs was obtained. The number of eggs reared in each month during 1931–34 are tabulated.

Most of the difficulties experienced in 1931 and 1932 were overcome. Gamasid mites and weevils could still be found in the cabinets but were not abundant enough to have much effect. In 1931 and 1932, 400 bushels of maize costing about £94 were needed to produce the 56

million eggs obtained, whereas in 1933 only 24 bushels of wheat costing about £5 were needed for the production of over 125 million eggs. In 1934 the mite, *Pediculoides ventricosus*, Newp., appeared in 5 of the cabinets and these were fumigated with carbon bisulphide in a specially constructed metal box for 24 hours. The cabinets were not set up until 10th February but nearly 76 million eggs were obtained and a peak of production of about 1 million a day was reached. Several small improvements were made to the cabinets during the year. The front door was hinged in the middle, the upper part being bolted to the cabinet and the lower part arranged so that débris could be removed from beneath the trays without losing many moths. This helped to reduce the number of mites and weevils present. Spraying the inside of the units and the trays of wheat twice daily with water increased production and induced a greater proportion of the moths to enter the collecting cans.

GAINES (R. C.). **Cotton Bollweevil Survival and Emergence in Hibernation Cages in Louisiana.**—*Tech. Bull. U.S. Dep. Agric.* no. 486, 28 pp., 9 figs., 6 refs. Washington, D.C., December 1935. [Recd. March 1936.]

A study of the hibernation of *Anthonomus grandis*, Boh., has been carried out at Tallulah, Louisiana, over the 15-year period 1915–16 to 1930–31, with the exception of the winter of 1926–27, and in 17 co-operating laboratories in various States during the last 7 years of the investigation. The tests were made in screen wire cages of a uniform size, and a standard procedure, which is described, was followed throughout, one variable being introduced into each series of tests. The average winter survival for the whole period under all cage conditions at Tallulah was 1·22 per cent. The percentages at most of the other stations were higher, because more favourable shelters were used and more of the weevils were placed in the cages after 6th October. The figures given below were obtained at Tallulah. In a study of the effect of time of entering hibernation the highest survival (2·55–2·92 per cent.) was among weevils placed in cages between 20th October and 18th November, and none of those placed in cages before 7th September survived. Among various materials provided in cages for shelter the highest survivals occurred in maize stalks (1·99 per cent.), followed by Spanish moss (*Tillandsia usneoides*) (1·66), Spanish moss and cotton stalks (1·44), sawmill débris (1·36) and oat straw (1·34). A much lower rate of survival occurred in a number of other materials and combinations. During the winters of 1925–26 onwards, the percentage surviving in Spanish moss was 0·57 in cages placed under standing timber and 0·88 in the open field.

In a study of the relation of survival to winter weather conditions, the only significant correlations were with minimum temperatures. Coefficients of correlation between survival and the number of times the temperature fell below 32°, 30°, 24°, 22°, 20°, and 18°F., respectively, were found to be significant, as were also those between survival and the number of times the temperature ranged from 18° to 20° and from 1° to 17°F., and that between survival and the minimum temperature for the winter. The weighted average percentage for the 4 years that the minimum temperature was 20°F. or higher was 3·96 as compared with 0·29 per cent. for the remaining years. Of the total number of weevils surviving, 15·7 per cent. emerged in March, 22·9 per cent. in

April, 39·7 per cent. in May, 21·4 per cent. in June and 0·3 per cent. in July. The emergence period for the different years ranged from 47 to 127 days, with a weighted average of 117 days, the extremely short periods of emergence being during the years of very low survival. Emergence extended into July in only 4 years.

Records of autumn and spring examinations of Spanish moss under natural conditions over the 15-year period are compared with survival in hibernation cages, minimum winter temperatures and total precipitation in a table and graphs. The two survival curves have practically the same trends, and there is a high degree of correlation between survival and minimum temperatures. There is also a positive correlation between minimum temperatures of the preceding winter and percentage increase of yield in experimental plots of cotton on which boll weevils are controlled with calcium arsenate. A marked correlation was also shown between increased yield and total precipitation for June, July and August. The curve for increased yield does not follow the survival curve so closely as it does the precipitation curve, showing that the final population at the close of the growing season depends more on the weather than on initial infestation.

Pink Bollworm Quarantine No. 52. Revision of Quarantine and Regulations.—*U.S. Dep. Agric. B.E.P.Q.* Q. 52, 8 pp. Washington, D.C., 1936.

This revision (effective 5th December 1935) of Quarantine no. 52 against *Platyedra* (*Pectinophora*) *gossypiella*, Saund., releases from restriction all parts of the State of Georgia formerly included in the regulated area. As careful inspections made throughout the area in 1934 and 1935 gave negative results, it is believed that eradication efforts have been successful there.

McKaig, jr. (N.) & Fort (C. A.). **Chemical Composition of Juice from Louisiana Sugarcane injured by the Sugarcane Borer and the Red Rot Disease.**—*J. agric. Res.* **52** no. 1 pp. 17–25, 10 refs. Washington, D.C., 1936.

An account is given of investigations into the composition of juice from sugar-canes injured by *Diatraea saccharalis*, F., and by red rot (*Colletotrichum falcatum*), carried out in Louisiana from 1931 to 1932. The following is based on the authors' summary :—

Comparisons of the juice from the sugar-cane show that the value of the cane is materially reduced by the borer alone and to a greater extent by a combination of borer and red rot injuries. In both cases, there is a decrease in juice extraction and in the percentage of solids and sucrose in the juice obtained, and the apparent and the true purity are correspondingly lowered. The percentages of reducing sugars, ash gums, alcohol-precipitable non-sugars, and total organic non-sugars are significantly increased. Both protein and non-protein nitrogen compounds are increased, especially the latter, resulting in a greater increase in the nitrogen content of the syrups. In the ash, potassium is increased somewhat more than the other elements, although all the mineral constituents of the juice are increased. When calculated to percentage of ash, the ratios between the different components are but slightly altered. The colour and the turbidity of the clarified juices and syrups are decidedly increased.

A comparison of four varieties commercially grown in Louisiana indicates that, in general, the changes in the chemical composition of the juices are greater in the case of the highly susceptible variety P.O.J. 213 than in the other varieties tested.

WAKELAND (C.) & SHULL (W. E.). **The Mormon Cricket with Suggestions for its Control.**—*Ext. Bull. Idaho Coll. Agric.* no. 100, 30 pp., 20 figs., 7 refs. Moscow, Idaho, February 1936.

The distribution of *Anabrus simplex*, Hald., in the United States and the history of previous outbreaks in Idaho are briefly reviewed, and an account is given of its bionomics and methods of controlling it [*cf. R.A.E.*, A **17** 479; **18** 284, etc.]. The current outbreak in Idaho has increased steadily since 1932, and infestation now covers about two million acres. This Tettigoniid has a one-year life-cycle, and in Idaho the eggs begin to hatch about the middle of March. The adult stage is reached in 75–100 days, and oviposition begins 10–15 days later in late June or July. The eggs incubate throughout the summer and early autumn, and the fully-developed nymphs pass the winter within the egg-shell. The nymphs and adults seek protection as soon as the temperature drops in the evening or during cool stormy days, and their habit of concentrating in dense groups in the late evening and early morning has an important bearing on their control by the use of arsenite dusts [*cf.* **17** 182]. They seem to prefer *Balsamorrhiza*, dandelion and young mustard plants, but will attack most green plants available and damage many kinds of crops. Their natural breeding grounds in Idaho, which are mainly at high altitudes, are indicated. In the current outbreak they have become so numerous that they have migrated downward to the dry-farming area and to some of the irrigated land adjacent to the breeding areas. The outbreak has remained apparently unaffected by one exceedingly severe winter and one very mild one. Egg destruction by rodents and possibly birds had little effect on the size of the population. Birds are the chief natural enemies of the nymphs and adults in Idaho. Hairworms, which infest them, are abundant in small streams in the neighbourhood of one of their breeding grounds.

Eggs in agricultural land may be ploughed under deeply late in the autumn or early in the spring to prevent the young nymphs emerging from the ground. Rivers, irrigation canals, trenches and fences form barriers to migration only under certain conditions. Descriptions are given of barriers to be placed across irrigation canals to catch the insects as they float downstream and of trench barriers. The most effective control is a poisoned dust of 3 lb. sodium arsenite or 4 lb. calcium arsenite mixed with 12 lb. hydrated lime, applied at the rate of 5 lb. per acre directly to the bodies of the nymphs with a hand-cranked dust gun soon after they hatch and while they are densely congregated. Owing to the frequent migrations, poison baits are not satisfactory, as they rapidly lose attractiveness if not consumed as soon as they are put down. In view of the variety of the migration habits, co-operation throughout an infested area is necessary to obtain control. Trained labour and transport are important factors and involve considerable expense. Camps must be established where the infestation occurs in remote areas. The problem of financing control is discussed.

Tooke (F. G. C.). **Insects injurious to Forest and Shade Trees.**—*Bull. Dep. Agric. S. Afr.* no. 142, 52 pp., 25 figs. Pretoria, 1935. Price 6*d*. [Recd. March 1936.]

An account is given of the bionomics of the principal insect pests of forest and shade trees in South Africa, including the Longicorns, *Phryneta spinator*, F. [*cf. R.A.E.*, A **8** 69] and *Phoracantha semipunctata*, F. [**17** 245], which are widely distributed on willow and *Eucalyptus* respectively.

A list is given of the trees infested by the Saturniid, *Nudaurelia cytherea*, Cram, which causes severe defoliation. *Pinus insignis* appears to be the favoured food-plant. The eggs, which are deposited in batches of 100–150 on the young shoots in the higher branches, hatch in 18–19 days. The larvae moult 5 times. Pupation takes place in the soil at a depth of 2 ins., generally near the base of the tree. A loose sandy soil is preferred. The pupal stage lasts 6–7 months, usually starting in early November. The moths emerge in late May and early June and only live for a short time. They are not attracted to baits, and are slightly phototropic. The larvae are subject to a disease and to parasitism by *Apanteles maculitarsis*, Cam., and two other Hymenopterous parasites destroy about 9 per cent. of the eggs. Pigs will root out the pupae efficiently; in one district they reduced the average number of pupae round the base of each tree from 150 to 0·36.

In 1926 and 1927 the Lasiocampid, *Nadiasa* (*Taragama*) *concolor*, Wlk., caused severe local defoliation of *Pinus insignis* in the western Cape area, and then declined. It has two generations a year. Adults emerge in late June and July. The eggs are laid almost at once and hatch in about 2 weeks. The larval stage lasts 8–10 weeks and the pupal about a month. New adults start emerging in November and are found with eggs and young larvae in December. The main defoliation occurs from January to March. Of the larvae or pupae in cocoons examined, 74 per cent. were killed by disease, and 16 per cent. by insects, including a Tachinid fly, *Sturmia dilabida*, Villen., 3 Ichneumonids, a Chalcid and the larvae of *Myelois ceratoniae*, Zell., which are usually fruit feeders but were found eating dead larvae. Control by hand-picking proved expensive.

In 1929, the Lymantriid, *Euproctis terminalis*, Wlk., defoliated *Pinus leiophylla* and *P. patula*, and to a less extent *P. insignis* and *P. pinaster*, in the eastern Transvaal. The infestation has become less severe, but is still quite serious, especially where delayed rains in the spring follow a dry winter. The adults emerge from the beginning of January to the end of February. The eggs, which are laid in batches on the trees, hatch in 2–3 weeks. The larval period lasts for the whole of autumn and winter, but the most serious defoliation occurs at the end of August and the beginning of September. The pupal stage, which is passed 2 ins. deep in the mat of pine needles, lasts from mid-October or November to January.

The Lasiocampid, *Bombycomorpha pallida*, Dist. (pepper-tree caterpillar) although it does less economic damage, sometimes defoliates *Schinus molle* (pepper-tree) grown for ornament or shade. About mid-October the eggs are deposited in clusters of 180–270 in a band 1 in. long round the stalks of the young leaves or twigs. They hatch in 18–25 days. The larvae, which are gregarious, pass through 5 instars in 46–58 days, and when mature, may travel 20–50 yards in search of a suitable place to pupate. They transform to pupae within 16–22 days

after the completion of the cocoon. The adults emerge about the end of January, second generation cocoons are formed from mid-April till the end of May, and adults appear again in mid-October. Parasitism of the larvae by the Tachinid, *Sturmia* (*Argyrophylax*) *bimaculata*, Htg., rises to 30–40 per cent. Infestation may be controlled by hand-picking and destruction of the branches bearing the larvae, or by spraying with $1\frac{1}{4}$ lb. lead arsenate in 40 gals. water.

The Saturniid, *Gonimbrasia tyrrhea*, Cram., strips the foliage of ornamental willows (particularly *Salix babylonica*), *Pinus insignis*, *Acacia*, poplars and oaks. The eggs are deposited in late September and October in batches of 100–150 surrounding the young shoots or twigs, and hatch in 12–21 days. The larvae eat the leaves and the bark of the young twigs. They pass through 6 instars, each lasting 10–14 days, and then may feed for 3–4 weeks before transforming to pupae. The pupal stage is passed 2–3 ins. deep in the soil and normally lasts from January to September, though a small second brood emerges towards the end of January and the beginning of February. Two parasites attack the eggs, and in some districts destroy a high percentage. Hand-picking the larvae is effective in slight infestations, and egg-masses may be destroyed with the branches bearing them.

Damage to timber by *Lyctus brunneus*, Steph., which has only recently been recorded in South Africa [*cf.* **19** 24], is increasing. The life-cycle occupies 7–12 months, and the beetles are normally active from October to February, mostly emerging in November and December. Two or more eggs are laid near one another in the pores of sapwood and hatch in 2–3 weeks. The larvae feed during the summer and pass the winter when practically mature. The pupal stage lasts about a month, the pupae occurring near the surface of the wood. The attack of these beetles is confined to the sapwood of recently seasoned timber [*cf.* **16** 585]. Control measures recommended include sterilisation by heat and chemical methods [*cf.* **16** 139].

The greenhouse thrips, *Heliothrips haemorrhoidalis*, Bch., has recently attacked pines, *Grevillea robusta* and *Eucalyptus*, causing serious reduction in the size of the crown and a drain on the vitality of the tree. The female lays 10–20 eggs singly in the tissue of the pine needle, and these hatch in 9–10 days. The larvae feed in colonies on the surface of the needle, avoiding the sunlight. The two larval instars together last 2–3 weeks, the pre-pupal stage a few hours and the pupal 4–6 days, so that 12 overlapping generations may occur in the year. The constant humidity and high temperatures, and the subdued light resulting from dense stocking and delayed thinning, are favourable for the development of the thrips. Heavy thinning and pruning of stands of *Pinus patula*, up to 8 years old, stopped infestations for about 2 years, until the crown canopy had again grown over. Trees of which the crowns have been reduced owing to injury by the thrips show a marked recovery after thinning. Pruning the trees only is not efficient for more than a few months. It is therefore recommended that stands of *P. patula* should be thinned and pruned when 3–4 years old, and regularly thinned subsequently at 5-year intervals. Heavy showers of rain also destroy infestations.

HARGREAVES (E.). **Entomological Work.**—*Rep. Dep. Agric. S. Leone 1934* pp. 16–18. Freetown, 1936.

Fruit-piercing moths attacking *Citrus* in Sierra Leone in 1934 were *Achaea catocaloides*, Gn., which was very abundant from early April to

1st June ; *Serrodes partita*, F., and *S. trispila*, Mab., which were prevalent from mid-March to mid-April ; *A. faber*, Holl., *A. lienardi*, Boisd., *A. mormoides*, Wlk., and *Othreis fullonia*, Cl. (*fullonica*, L.), which were common from mid-April to early June ; and *A. catella*, Gn., *A. dasybasis*, Hmps., *A. indicabilis*, Wlk., *Anua tirhaca*, Cram., *Sphingomorpha pudens*, Holl., and *S. xanthoperus*, Hmps. The generation of *O. fullonia* and *O. divitiosa*, Wlk., that is normally present in November and December did not develop. The larvae of *O. fullonia* were found feeding on *Stephania dinklagei* and *Triclisia patens* and those of *O. materna*, L., on *Rhigiocarya racemifera*. Demerara sugar proved more attractive in poisoned baits than cheaper brown sugar. Of 3 formulae tested 2 gm. sodium arsenite, 150 gm. sugar and 1,200 cc. water gave the best results ; in a laboratory test adults of *O. fullonia* died within 1 day after feeding on it.

Ground-nuts [*Arachis hypogaea*] on lightly-shaded plots were not affected so early or so severely by mosaic disease [*cf. R.A.E.*, A **21** 446] as those in the open, probably because the ants attending the Aphid vector [*Aphis laburni*, Kalt.] prefer the open. Only the " rosette " type of mosaic disease seriously affects the yield, and if infection occurs after the plant is about half-grown, there is apparently little reduction. Experiments indicated that infected Aphids retain the power of infection after moulting, but do not transmit it to their offspring. Avocado was seriously attacked by a thrips during January to March and in some cases was almost entirely defoliated. Nicotine sulphate (1 : 800) was effective.

Between February and April 89 small swarms of *Locusta migratoria*, L., were recorded. The main infestation of hoppers occurred in the west but there were also many outbreaks along a railway, apparently because the early burning of the adjacent vegetation had produced areas attractive for oviposition. In one area numerous hoppers and adults approaching the solitary phase were present. Little damage was caused. *Zonocerus variegatus*, L., continued to oviposit until the end of April. About 30 per cent. of the adults were found to be parasitised by Diptera.

Pests that have recently been identified are *Corcyra cephalonica*, Stn., in stored pigeon peas [*Cajanus indicus*], the Coreids, *Leptocorisa apicalis*, Westw., and *Mirperus torridus*, Westw., which are sometimes injurious to rice ears in the " milk " stage, *Acrocercops coerulea*, Meyr., and *Euchrysops malathana*, Boisd., both on beans and cow-peas [*Vigna*], and *Spalgis lemolea*, Druce, the larvae of which live on the mealybug, *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., which is sometimes a serious pest on coffee and guava. Nicotine sulphate (1 : 800) effectively controlled the Psyllid, *Mesohomotoma tessmanni*, Aulm., on kola [*Cola acuminata*] without injuring the plant. In fumigation trials with carbon bisulphide against pests of stored rice, an exposure of 48 hours at a concentration of 7½ lb. per 1,000 cu. ft. was necessary to be thoroughly effective.

Lyctus **Powder-post Beetles.**—*Leafl. For. Prod. Res. Lab.* no. 3, 5 pp., 4 figs., 6 refs. Princes Risborough, Aylesbury, 1936.

This revision of an earlier leaflet [*R.A.E.*, A **18** 520] gives a brief general account of the beetles of the genus *Lyctus* infesting timber in Britain. Among the recommendations for control in buildings, furniture, etc., are the elimination of all sapwood from timbers before

installation or manufacture, the substitution of heartwood for infested sapwood, and treatment with a suitable proprietary insecticide. This should be done with brush or spray, and should be repeated until there is no further evidence of activity. Starch-free wood is immune from damage [*cf.* **24** 8].

Sale of Diseased Plants (Amendment) Order of 1936.—*S.R.O.* 1936 no. 163, 2 pp. London, 27th February 1936.

This Order, which came into force on 1st May 1936, extends the provisions of the Sale of Diseased Plants Order of 1927 [*R.A.E.*, A **15** 481] to prohibit the sale for planting in England or Wales of any tomato or cucumber plant that bears evidence of having been affected by *Trialeurodes vaporariorum*, Westw., and any potatoes or narcissus or daffodil plants or bulbs that are visibly rendered unfit for planting by reason of their having been affected by any pest.

The Importation of Plants (Amendment) Order of 1936.—*S.R.O.* 1936 no. 313, 4 pp. London, 3rd April 1936.

This Order, which came into force on 1st May 1936, modifies the Importation of Plants Order of 1933 [*R.A.E.*, A **21** 426] and subsequent amendments. A certificate in one of two forms must accompany living plants, potatoes, raw vegetables and cider apples imported into England or Wales from Belgium. The first form certifies that the produce was grown outside a radius of 50 kilometres from an outbreak of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] and the second that the importation is permitted by a general licence granted by the Minister of Agriculture and Fisheries and that the conditions laid down in the licence have been observed. The second alternative is not applicable to potatoes, but is extended to other produce from France. Flower bulbs, cucumbers and mushrooms are exempted from the requirement of the first form, and this exemption is extended to such produce from France. The requirement of the first form applies, so far as raw vegetables and cider apples are concerned, only during the period 21st April–14th October in any year. Certificates of origin will no longer be required for cucumbers and mushrooms grown in countries other than France or Belgium.

Balachowsky (A.). **Contribution à l'étude des Coccides de France (20e note). Sur un nouvelle Lecanine hypogée du Midi de la France.**—*Bull. Soc. ent. Fr.* **41** no. 4 pp. 56–59, 10 figs. Paris, 1936.

The female of *Lecanium* (*Eulecanium*) *grassei*, sp. n., is described from the roots of fennel [*Foeniculum*] growing on the beach in the Pyrénées-Orientales. The food plant in this district appears to be chlorotic and unhealthy, probably because of the attack of the Coccid, which was found at a depth of 6–8 ins.

Mayné (R.). **Le Doryphore, fléau entomologique moderne.**—*Bull. Soc. ent. Belg.* **76** no. 1–2 pp. 19–27. Brussels, 25th February 1936.

A brief account is given of the history of introductions of *Leptinotarsa decemlineata*, Say, into Europe and of the measures undertaken to eradicate it in Belgium, where it was first found in 1935 [*cf. R.A.E.*, A **23** 739, 740; **24** 86]. Data on its bionomics are reviewed, and it is concluded that in Belgium the overwintering adults would remain in

the soil from late August or September until May or June (when the temperature rises to 12–14°C. [53·6–57·2°F.]), and that there would be two generations a year.

MANEVAL (H.). **Nouveau genre et nouvelles espèces de Platygasterinae (Hym.) de la faune franco-belge.**—*Bull. Soc. ent. Belg.* **76** no. 1–2 pp. 45–58, 8 figs. Brussels, 25th February 1936.

The four new species described include *Misocyclops crevecoeuri*, which was bred from galls made by the Cecidomyiid, *Lasioptera rubi*, Heeg., on *Rubus* in Belgium.

GÖSSWALD (K.). **Zur Frage nach der Abhängigkeit der Entwicklung des Kiefernschwärmers *Sphinx pinastri* L. von Temperatur und Luftfeuchtigkeit.** [The Question of the Dependence on Temperature and Air Humidity of the Development of the Pine Sphingid.] —*Z. angew. Ent.* **22** no. 4 pp. 521–532, 1 fig., 5 refs. Berlin, January 1936.

The importance of climate in outbreaks of major Lepidopterous forest pests in Germany is known, but there are also several other Lepidoptera that are physiologically capable of even greater damage but do not become noticeable pests. *Sphinx pinastri*, L., on pines is an example, and its constant population implies a marked independence of such variable factors as temperature and humidity. A study of these two factors was therefore made on the offspring of moths from pupae collected in various forest areas, about 30 per cent. of which were parasitised.

At temperatures of 10–35°C. [50–95°F.], which are those found in nature during larval development, no larval mortality occurred. Variations in humidity had little effect, for deaths occurred only in constant very high (100 per cent.) or very low (20 per cent.) humidities. In nature temperature and humidity are therefore unimportant. From 20 to 35°C. [68–95°F.] the duration of larval development varied only slightly. Adults emerged from all the pupae kept within a range of 10–35°C. at 90 per cent. humidity and at 16°C. [60·8°F.] between 100 and 20 per cent. humidity. The pupae can therefore withstand conditions more extreme than those that obtain in the conifer-needle ground-litter which is their habitat. There were two types of pupal development. A high temperature of 25–35°C. [77–95°F.] either caused emergence to occur shortly following pupation or after 5 months (in December or January). There were no pupal periods intermediate between these two. Two generations a year are therefore possible in especially warm districts, but no second generation occurred near Munich in 1934. It is concluded that the constant level of the population density of *S. pinastri* is due to its independence of climatic variations, while its low level is due to parasites.

v. ARNIM (Frhr.). **Zur Kenntnis der Temperaturabhängigkeit der Nonne (*Lymantria monacha* L.). (Vitale Zone. Aktivitätsschwellen usw. der Entwicklungsstadien.)** [On the Temperature Dependence of the Nun Moth. (Vital Zone. Thresholds of Activity etc. of the developmental Stages.).]—*Z. angew. Ent.* **22** no. 4 pp. 533–557, 2 figs., 23 refs. Berlin, January 1936.

In 1933 an increase of *Lymantria monacha*, L., began in East Prussia and developed into a serious outbreak. As a preliminary to field

investigations, laboratory experiments with larvae and pupae and with eggs collected in the winter of 1933–1934 were made to ascertain the effect of temperature. A full account is given of the methods used and results obtained, preceded by a survey of the more important publications on the influence of temperature on insects.

In nature the egg-stage lasts from August to April [*cf. R.A.E.*, A **23** 536]. Tests with temperatures ranging between —3 and —24°C. [26·6 and —11·2°F.] showed no difference in behaviour between eggs exposed in a dry state or those frozen in ice (for up to 14 hours). This indicates a very slight respiration at such temperatures. Larvae hatched from 50–90 per cent. of the eggs cooled down to —13°C. [8·6°F.]. This resistance to cold decreased from winter to spring, as the date of hatching approached. The fatal temperature was at about —16°C. [3·2°F.]. The larvae were able to hatch from eggs that had not been frozen, but it is possible that mortality may be higher in such eggs.

In nature extremes of cold (frosts) and heat (direct sunshine) harmful to the larvae are most likely to affect them when they are in the first instar, during the second half of April. Full particulars of the results with cold and heat in all five instars are shown in a graph. Some of the first-instar larvae became numb at —0·5°C. [31·1°F.] while all were numb at —1°C. [30·2°F.]. Erratic movements occurred between —0·5°C. and 1·2°C [34·16°F.] In the fifth instar erratic movements began at 1·3°C. [34·34°F.] and numbness at about —0·1°C. [31·82°F.]. In the five instars death occurred at various temperatures at or below about —6°C. [21·2°F.]. As regards heat, erratic movements usually began at 37°C. [98·6°F.] and numbness between 42·5° and 44·5°C. [108·5° and 112·1°F.]. Some larvae died at 44·5° and none survived 46°C. [114·8°F.].

No extensive experiments were made with the pupae, as some preliminary tests showed the lethal high and low temperatures to be far outside the range of temperatures in the normal area of distribution of *L. monacha*, but it is stated that a pupa exposed for 24 hours to —9·4°C. [16·52°F.] produced a normal male.

It is concluded that *L. monacha* in all its stages is well adapted to seasonal changes in temperature and withstands all the extremes normally found in nature.

SCHIMITSCHEK (E.). **Ergebnisse von Parasitenzuchten.** [Results in Breeding Parasites.]—*Z. angew. Ent.* **22** no. 4 pp. 558–564, 9 refs. Berlin, January 1936.

This is a list of parasites bred from forest pests in Austria arranged according to hosts. Some hyperparasites and predators are included. References are given to papers dealing with the morphology and biology of the parasites.

SCHIMITSCHEK (E.). **Das Massenauftreten des Tannentriebwicklers *Cacoecia murinana* Hb. in Niederösterreich 1929–1934.** [The Outbreak of the Silver Fir Shoot Tortricid, *Tortrix murinana*, in Lower Austria in 1929–34.]—*Z. angew. Ent.* **22** no. 4 pp. 565–602, 16 figs., 25 refs. Berlin, January 1936.

In 1934 an outbreak of *Tortrix* (*Cacoecia*) *murinana*, Hb., occurred in an Austrian forest area where this moth is frequently found. Notes are given on the topography of the area and on some previous outbreaks

there. The average annual temperature is 8–9°C. [46·4–48·2°F.] and the total rainfall 705·3 mm. Silver firs [*Abies*] were principally infested. Spruce [*Picea abies*] and larch were severely attacked locally, and *Pinus sylvestris* and *Picea pungens* exceptionally. The outbreaks have always occurred in the same stands on more or less steep slopes facing south or south-west. A graph shows the course of this outbreak from 1927 to 1934, when it reached its peak and then suddenly collapsed owing to extreme drought from 27th June to 15th July and heavy rain on 16th and 17th July, and its relation to weather and sun spots is discussed. In the outbreaks that reached their peaks in 1876–77, 1889, 1911, and 1933–34, the beginning of an increase coincided with a sun spot maximum, and the peak either coincided with the minimum or was near it.

The scanty literature on parasites of *T. murinana* is noticed. Of those bred from pupae collected during this outbreak, *Pimpla maculator*, F., was the commonest and most important, *Ichneumon varipes*, Grav., the second in importance, and *Pimpla examinator*, F., the third. These Ichneumonids parasitise the larvae and pupate in the host pupa. Other parasites were, in order of importance, the Ichneumonids, *Pimpla mussi*, Htg., *Glypta resinana*, Htg., with *G. nigrina*, Desvignes, which is considered a variety of it, *Hemiteles sordipes*, Grav., *Microcryptus murinanae*, sp. n., both sexes of which are described by Fahringer, the Braconid, *Meteorus scutellator* var. *unicolor*, Wesm., and the Tachinid, *Ptychomyia selecta*, Mg. The Ichneumonid, *Pimpla rufata*, Gmel., and the Chalcid, *Mokrzeckia* (*Pteromalus*) *pini*, Htg., were also bred. Ants attacked the pupae. From breeding results and observations in the field, the parasites appeared unable to check an outbreak unaided. There was no apparent relation between the percentage of parasitism and the pure or mixed character of the stands, nor was there any marked difference due to the host pupae being in the ground litter, on the trunks or in the crowns. As *T. murinana* has one generation a year and its parasites have two, they must require alternative hosts, and this is probably the chief reason for their ineffectiveness.

The bionomics of *T. murinana* are dealt with briefly. In 1934 the moths began to appear on 9th June, and the eggs on 24th June. The eggs were laid, in batches of 25 usually, on needles in the upper part of the crowns of older trees, never on young trees. The larvae hatched from 6th to 16th July. They fed on the May shoots, never on needles of the previous year. Their hibernation quarters could not be ascertained. While the injury done to silver fir by *T. murinana* is not fatal, it interferes with normal growth and renders the trees susceptible to secondary pests, which in these districts included *Rhagium* (*Harpium*) *inquisitor*, L., *Pissodes piceae*, Ill., *Cryphalus piceae*, Ratz., *Ips curvidens*, Germ., and *I. spinidens*, Rttr., and in a few isolated cases, *Taphrorychus bicolor*, Hbst. The amount of infestation by these beetles renders their control imperative when an outbreak of *T. murinana* occurs.

GERMAR (B.). **Versuche zur Bekämpfung des Kornkäfers mit Staubmitteln.** [Experiments against the Grain Weevil with Dust Insecticides.]—*Z. angew. Ent.* **22** no. 4 pp. 603–630, 9 figs. Berlin, January 1936.

Experiments have been made at Bonn to ascertain whether non-poisonous dusts, especially a proprietary powder (Naaki) of silicic acid,

are able to destroy *Calandra granaria*, L., in stored grain and protect the latter against new infestations. The proprietary dust proved far superior to all others. It is a pure quartz sand ground to different grades of fineness, all of which include particles of colloidal size. It consists on an average of 98 per cent. silicic acid with a small amount of aluminium, iron, lime and magnesium salts, and only few quartz sand pits in Germany are able to supply the raw material. The coarsest grade tested contained particles from colloidal size to 150 μ, coarse particles predominating. In the second grade the size ranged from colloidal to 12 μ, with many coarse grains. In the finest grade the range was from colloidal to 5 μ. In tests with weevils removed from the grain the coarsest grade killed them less speedily, but the difference was quite unimportant from a practical point of view. Colloidal particles obtained by water suspensions were therefore expected to be especially effective, but they formed lumps that failed to adhere to the weevils. It is the ability to adhere and to penetrate into the joints that conditions effectiveness. In other tests with *Bruchus* (*Bruchidius*) *obtectus*, Say, and *Oryzaephilus surinamensis*, L., complete mortality was also attained, though 1 or 2 days later than with *C. granaria*. With *C. granaria* death was so rapid in a dry atmosphere of 42–45 per cent. relative humidity that differences of temperature were of little account, all the weevils being dead after 2 days. In air of 85–90 per cent. humidity mortality was complete after 2 days at 38·5°C. [101·3°F.] and after 10 days at 10°C. [50°F.]. At 23°C. [73·4°F.] total mortality occurred after 1 day at 21 per cent. humidity and after 20 days at 100 per cent. The particles probably continually enter the joints and are there pressed together. The dust kills by desiccation, and as it is not hygroscopic, capillary action conducts the water to the air, which takes it up. The dust therefore acts as a conductor merely, the dryness of the surrounding air being an important factor. The dust hindered movement, especially of the mouth parts, thus at once decreasing the injury to grain. Young weevils, and also young *B. obtectus*, were more sensitive than older ones because their chitin was not hardened. In tests with infested grain, all young weevils emerging from the seeds were killed before they were able to reproduce. The amount of dust required was 1 per cent. of the weight of the grain. Treated grain can be almost completely freed from the dust by air suction or quite completely by washing. Rye treated for over 5 months germinated normally and satisfactorily. Store rooms can be disinfested by carefully clearing away all débris and then strewing the powder and dusting it, about 1 lb. per 82 sq. yds. of surface being required.

Puzanova-Malysheva (E. W.). *Syntomaspis eurytomae* **nov. sp., eine Chalcide mit gemischter Ernährung im Larvenstadium.** [*S. eurytomae*, sp. n., a Chalcid with a mixed Diet in the larval Stage.] —*Z. angew. Ent.* **22** no. 4 pp. 631–642, 8 figs., 13 refs. Berlin, January 1936.

Descriptions are given of both sexes of the Torymid, *Syntomaspis eurytomae*, sp. n., which was found in the spring of 1928 in stones of plums (*Prunus insititia*) that had lain on the ground in winter in the district of Kursk (Russia), together with an account of its biology. The following is taken from the author's summary : The larvae live in the stones of *Prunus insititia* infested by *Eurytoma amygdali*, End.

Adult flight begins in the last third of June and continues for about a fortnight. The egg is laid on the almost full-grown larva of *E. amygdali* in the stone of a large but still immature fruit. The newly hatched larva is very mobile and moults in 3–4 days. Both it and the sluggish second-instar larva are described. Within 12 days the host has been devoured and the larva then eats the remainder of the kernel left by it. It hibernates in the stone without a cocoon and pupates towards the end of May. The pupal period lasts 24–27 days.

ECKSTEIN (K.). **Der schwarze Fichtenbastkäfer,** *Hylastes cunicularius* **Er.** [The black Spruce Bast Beetle, *H. cunicularius*.]—*Z. angew. Ent.* **22** no. 4 pp. 643–652, 2 pp. refs. Berlin, January 1936.

Hylastes cunicularius, Erichs., is well known on spruce in Germany, but attracts little notice, as no outbreak has been recorded during the past 50 years. Information on it is given from the literature, recent papers being those on its biology and control in Sweden [*R.A.E.*, A **10** 64; **22** 269]. Conflicting views regarding the number of generations a year in Germany are discussed.

PAPERS NOTICED BY TITLE ONLY.

VAPPULA (N. A.). **Finnish Entomological Literature published in 1934 including Economic Entomology and Control of Insect Pests** [including 74 titles on economic entomology].—*Suom. Hyonteistiet. Aikakausk.* **1** nos. 2–3 pp. 70–80, 107–112. Helsinki, 1935. [Recd. March 1936.]

BERAN (F.). **Pflanzenschutzmittel, I. Nachtrag.** [First supplement to 1935 Austrian official list of materials for plant protection.]—*Neuheiten PflSch.* **29** no. 1 pp. 10–12. Vienna, February 1936. [*Cf. R.A.E.*, A **23** 347.]

ROBINSON (R. H.). **Sprays, their Preparation and Use.**—*Sta. Bull. Oregon agric. Exp. Sta.* no. 336, 30 pp., 1 chart. Corvallis, Ore., June 1935. [Recd. March 1936.] [Revision of previous bulletin; *cf. R.A.E.*, A **15** 184; **18** 355.]

KNOWLTON (G. F.) & ANTHON (E. W.). **Herpetological Notes.** [Records of insect food of a lizard (*Uta stansburiana*) in Utah.]—*Copeia* no. 4 reprint 1 p. New York, 31st December 1935. [*Cf. R.A.E.*, A **23** 33.]

BOURNE (A. L.) & SHAW (F. R.). **A Fungus infesting Onion Thrips** [*Thrips tabaci*, Lind., in Massachusetts].—*Bull. Brooklyn ent. Soc.* **31** no. 1 pp. 15–17, 4 figs. Lancaster, Pa, February 1936. [*Cf. R.A.E.*, A **21** 417; **22** 650; **23** 655.]

TAUBENHAUS (J. J.) & CHRISTENSON (L. D.). **Insects as possible Distributors of** *Phymatotrichum* **Root Rot** [negative experiments with insects and *P. omnivorum* of cotton in U.S.A.].—*Mycologia* **28** no. 1 pp. 7–9. Lancaster, Pa, 1936. [*Cf. R.A.E.*, A **22** 570.]

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Fisher (W. S.). **New Cactus Beetle** [the Lamiid, *Alcidion cereicola*, sp. n., on *Cereus*] **from Argentine Republic (Cerambycidae).**—*Proc. ent. Soc. Wash.* **38** no. 1 pp. 7–8. Washington, D.C., February 1936.

de Vos-de-Wilde (B.). **Contribution à l'étude des larves de Diptères Cyclorrhaphes, plus spécialement des larves d'Anthomyides.**—*Proefschr. Univ. Amst.* 125 pp., 23 pls., 4 figs., 5 pp. refs. Amsterdam, 1935. [Recd. March 1936.]

Wilkinson (D. S.). **A List of Lepidoptera from which Parasites are particularly desired.**—*Entomologist* **69** no. 875 pp. 81–84. London, April 1936.

Yatomi (K.) & Sekiguchi (S.). **Speed of Flight in** *Chilo simplex* **Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 1 pp. 55–56. Tokyo, February 1936.

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